

The AUTOMOBILE

1916 Body Design Is Uniform

Best of Last Year Is Now Average.
Form, Color and Comfort All Improved
at Both Palace and Astor Shows

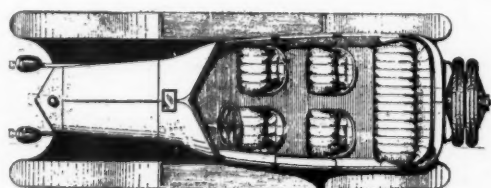
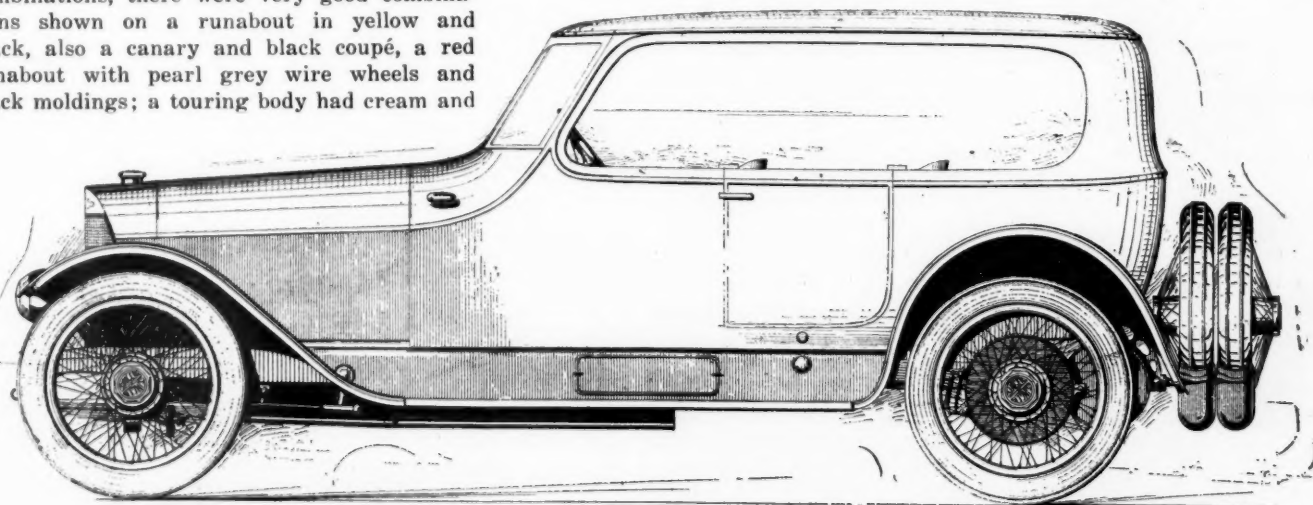
By G. J. Mercer

THE Palace and Astor Hotel shows just concluded, present in the body designs displayed, a more uniformly worked out plan to develop the streamline effect, than in previous years. This is particularly noticeable in the fore part of the car, and in both shows, with the exception of a negligible number, the line from the radiator to the body both on the sides and the top, presents a graduated surface, so that viewed from a distance, in many cases it is difficult to determine just where the engine hood ends and the body proper commences.

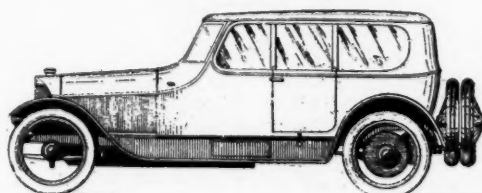
The Palace exhibition outshone all previous years in color combinations, there were very good combinations shown on a runabout in yellow and black, also a canary and black coupé, a red runabout with pearl grey wire wheels and black moldings; a touring body had cream and

brown with Spanish leather. There was a dark grey sedan and a very pleasing grey and black sedan; a dark grey limousine, a coffee and black touring body, a wine colored coupé, a green and black touring body, a wistaria sedan, a white and grey limousine and a white and black limousine. These are a few of the best combinations, most were in good taste, only a few violated the rules and had combinations that made a glare in place of a pleasant sensation.

In the Astor show the color combinations were less conspicuous than at the Palace, grey or white and black, and yellow and black were used, but not extensively, and the trim-



A new style body
by Bender and Rob-
inson on a Singer
chassis at the Astor
show



gings were suitable to match the car colors; in one Armstrong closed body, and in one Holbrook open body, a soft undressed leather trimming was used; the majority had the regulation cloth goods with dark leather for the front seats.

In the following not all the good things at the shows have been enumerated, nor have all the commendable designs been illustrated, but to the best of the writer's ability, those things that are of interest to the greatest number have been given prominence. Both shows serve their separate purpose and as long as one is not a duplicate of the other there will be room for both, one the manufacturers' exhibit of standard make, and the other special designs particularly in bodies, for those that are desirous to have automobiles custom made.

Smoother Bodies at Palace

Returning to the consideration of body shapes as noticed at the Palace show the first point is that the sides of the bodies have a smoother surface, due to the absence of moldings. This is true even of the doors, where the customary tee molding has been replaced by allowing the panel sheet to extend and cover the door openings. The top line of most of the touring bodies and runabouts and the driving compartment of closed bodies show rounded edges and on these closed bodies the overlap panel in which moldings are not used to join the upper and lower panels, was the rule and not the exception, also the seat trimming roll does not show above the body line, or if it does, it is very much reduced in size over former years.

There are fewer slanting windshields than was to be expected, considering the general desire to eliminate wind resisting surfaces, but there are more shields placed on top of the cowl panel and forward of the rear edge of the cowl and there are fewer cowls having the extreme upward tilt to the top line, near the shield seating.

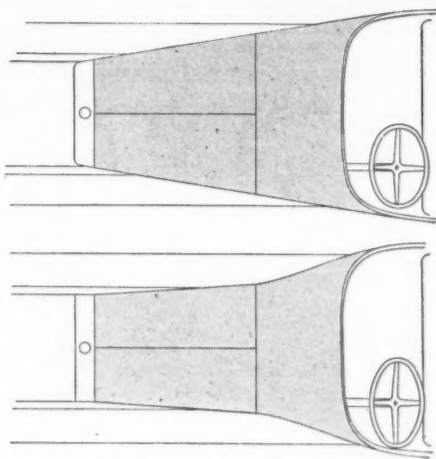
Touring Body Holds Position

The touring body still holds its own as the most representative member of the automobile family, and the type with a second cowl, not only shows a large increase in numbers, but the effect of its popularity is proved by the desire to imitate it, by minimizing the height of the driving seat back, and in some cases, rounding it to give the appearance of half a cowl. This tends to give the bodies a lower appearance and the elimination of the trimming rolls helps to accomplish this end. In reality the bodies are lower, measured at the seat back, but the sides are slightly higher; 24 to 25 in. is the average side panel height. The aisle between the driving seat also shows gain in numbers and in some cases the second cowl itself is divided.

The disappearing seat, despite the fact it is not so roomy as the older form of side seat, has proved to be the only style that is acceptable on both open and closed bodies, and the most popular is the one that folds into the back of the driving seat.

The four-passenger clover leaf runabout is the new idea this year. Last year there was one three-passenger body, and while, now, the majority on exhibition were only comfortable seating for three, there were two, the rear seat of which could accommodate two adults and one of these bodies was 42 in. wide on the cushion by 24½ in. from trimming or rear seat to panel of front seat.

One expected to see quite a number of good looking designs of demountable tops fitted to touring and runabout bodies,



Figs. 1 and 2, showing plan views of two bodies with contrasting cowl taper

the demountable top has been featured so much in automobile advertising of late, that naturally we looked for a better showing than there is. The Kissel, which is one of a very select few that look like jobs, showed one car with the inside stripped of its trimming, showing the method of attaching and detaching the upper section so it could be readily understood. The other tops exhibited have the effect of marring the general clean look of the body by the excessive width of the framing pillars, which only proves that to make a successful demountable top, it must be made with the body as part of the original design and not added as an afterthought.

The permanent-roof body shows increased numbers over last year. The regular Springfield body is on a number of cars and there is an adaptation of the Springfield idea on two others. Pierce had a body of this type in which the pillars fold down inside and are fitted with an automatic hinged arm for holding them in their respective positions. The only full collapsible all-weather body was exhibited by the Springfield Metal Body Co.

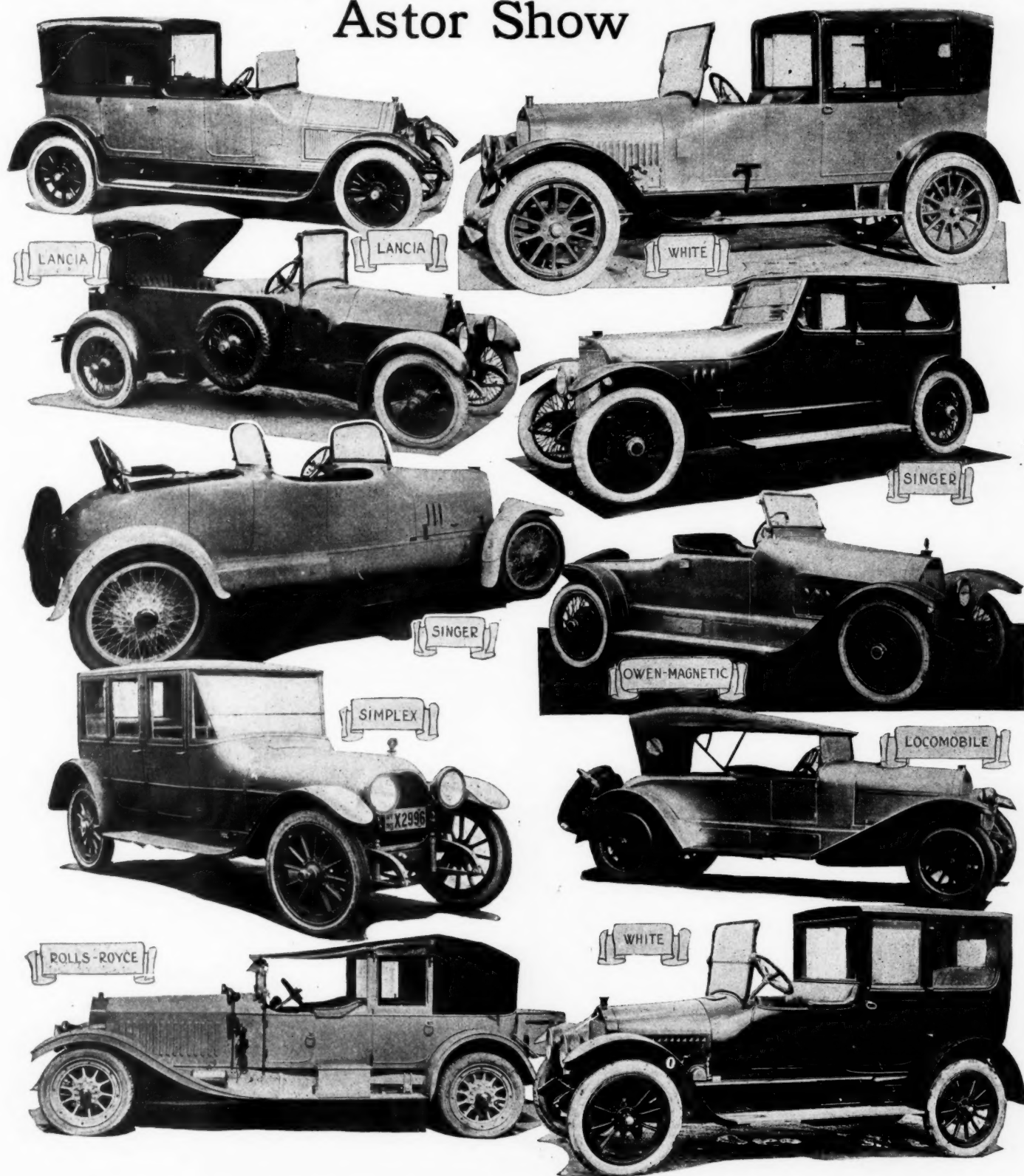
Few Innovations

The Palace show from a body point of view, had practically no features that were innovations, the average this year was virtually the duplicate of the best in the show last year and many of those that excelled last year, had the same exhibit this time. The Palace average was very good in finish, design and workmanship and novelties were conspicuous by their absence. There were fewer closed bodies in proportion to the total exhibit than formerly, but town cars, which have never been very numerous at this exhibit, were about the same in number and are of better design than formerly, but there is one feature in which this show outdid all its former records, and that is in colors. Hardly an exhibit but had its white or white and black, or yellow and black, or grey, or some other light color, and the striping of the hood and wheels was louder and more prominent than ever.

The word streamline has become the synonym for the latest in body design and is used indiscriminately for every body that shows a tapered line from the radiator to the cowl. Truthfully speaking the only bodies that approach the true streamline effect are the runabouts. To understand this, imagine a shape exactly like an egg placed on wheels, the large end toward the front, as the egg moves forward separating the air, the pressure of the atmosphere is increased by the displacement, and as the air currents pass along the sides, due to the egg moving forward, they meet easily and without clashing at the tapered rear end, and no revolving eddies or air currents are set up to disturb the road dust as the body passes forward. No body design in the near future is going to be built along these ideal lines, except the before-mentioned runabouts, no real necessity exists to disproportionate the rear end of a limousine or a touring body to make it egg-shaped and there is also the item of additional cost of construction. The fore part of the body that breasts the wind, is the part that has a commercial value, and eliminating the flat surfaces at the front and on the sides is the real money saver. Summing up the above logic, the writer suggests that "fore-streamline" would be a more applicable term to use, as it would cover all that we are trying to accomplish in body designing at the present time, that is, giving the front of the car the minimum of resistance.

Figs. 1 and 2 show the plan view of the hood and cowl of two touring bodies at the Palace, Fig. 1 is the newest de-

Some Examples of Typical Bodies at the Astor Show



THE Astor exhibition is always productive of many different styles of body construction. Both old models and the most advanced examples of modern tendencies may be seen side by side. The ten bodies shown here are representative of

most of the new ideas and it will be noticed that the Astor show, like that at the Palace, contained many examples of the clover leaf. The number of comparatively small capacity bodies is also noteworthy, though many were very large.

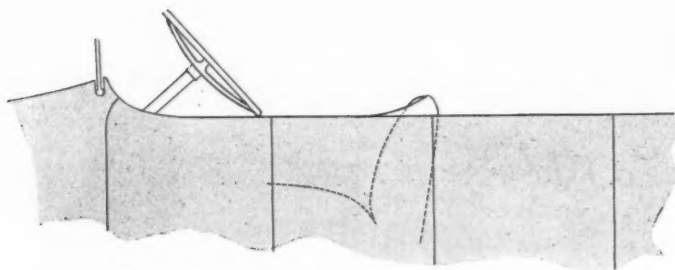


Fig. 3—Example of lowered back driving seat

sign and there is a taper of approximately 6 in., each side in the length of the hood. The body line continues from this without a ripple, to the widest part, this being a fine example of a fore-streamline. Of stock cars the Mercer is one of the best of this class. Fig. 2 is an example of one of the more conservative makes of cars, it marks a slower growth and lacks the bold straight appearance that characterizes Fig. 1. The top line of the hood has the same appearance on most cars as the side line of Fig. 1, from radiator to dash, the average raise is 2 to 3 in., the radiators are similar to last year, those with the slightly rounded edges predominating.

Figs. 3 to 8 are sketches of Palace show bodies.

Fig. 3 is an example of the lowered driving seat back rounded over like half a cowl, on this particular body the back below the cowl had two compartments that are used to stow away the top curtains.

Fig. 4 shows a runabout deck cover supported in the open position by arms that travel in slides at the bottom and drop into pockets at the slide end when raised.

Fig. 5 shows the rear seat of a runabout and the method of locking the lid in position to form the back, it shows a cheap way to make a seat in a small rear compartment and still be able to raise the lid when the top of the car is down.

Kissel All Year Is Sound Job

Fig. 6 is a diagram of the interior of the Kissel demountable top body, A shows the lock that fastens the upper part of the door to keep it from rattling, it engages in a plate in the body pillar and is operated by B, this lock is operated by the inside or outside handle and the push rod moves up and raises A and when the handle is released A drops into its place in the pillar, the push rod rests in the lock A and disengages itself when the top section of the body is lifted off; C shows the attaching lugs; the bolts used to fasten these are always accessible, being covered by flaps in the trimming.

Fig. 7 is a four-passenger runabout adapted from the clover-leaf idea the plan view shows the seating arrangement and the second cowl is divided by a passage way.

Fig. 8 is the outline of a town car body on the Owen Magnetic, there is only one door for the driver on the right side, the glass space at the front is unusually large and has rounded top corners, the driving compartment is joined to the body by a second cowl; this body was one of the best designs exhibited.

Low Appearance Favored

The coefficient of streamline in body nomenclature is *low looking* and the effort to produce this effect has replaced 36-in. tires with 34 and 32 sizes, the running board has come nearer the ground and a little additional kick up to the chassis frame sends it down forward of the rear wheel. The double drop to the frame has not had many converts. Pierce did this in place of reducing the tire size. The optical effect of raising the hood and cowl helps to make the touring and runabout look lower, but the greatest gain has been in lowering the seats, since the gasoline tank has been placed at the rear. The driving seat has been lowered 3 in. on touring and about 6 in. on runabouts and the slant of the cushions is about $2\frac{1}{2}$ in., so that on touring bodies the driver actually is about $5\frac{1}{2}$ in. lower when seated than formerly. The seats have been moved farther back to allow the extra leg room required when seated low and the steering wheel has been lowered and the column lengthened to accommodate the seat, in many bodies the driving seat is now made adjustable, because the driver sitting more straight out than formerly, it is not practical to expect men of different heights to accommodate themselves in the same sitting space. At present this is only done on touring and sedan bodies where the aisle between the seats makes the driving seat a free agent. On closed bodies, such as limousines, etc., the driving seat is much the same as formerly, on account of the necessity of having the door to the body as large as possible, and the driver is placed as far forward as freedom of movement and the proper room to sit will permit.

Cushion Height Decreasing

The average height of the front and back seat cushions from the floor at the front of the cushion is 15 in. on touring bodies with an average slant of $2\frac{1}{2}$ to 3 in. This applies to the rear seat in closed bodies also. There are a few touring bodies in which the rear seat cushion is only 12 in. up, but this is a height that no woman can either sit down on or

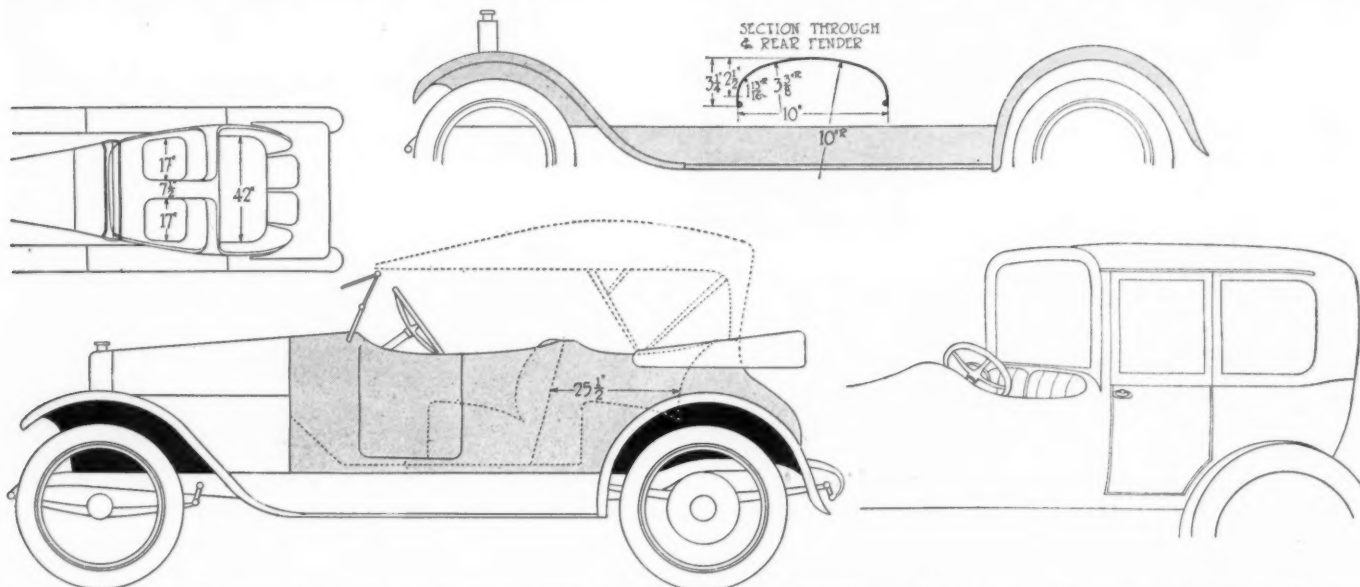


Fig. 7—Side and plan views of a good four-passenger roadster. Fig. 8—A well-proportioned town car. Fig. 9—Proportions of Chalmers front and rear fenders

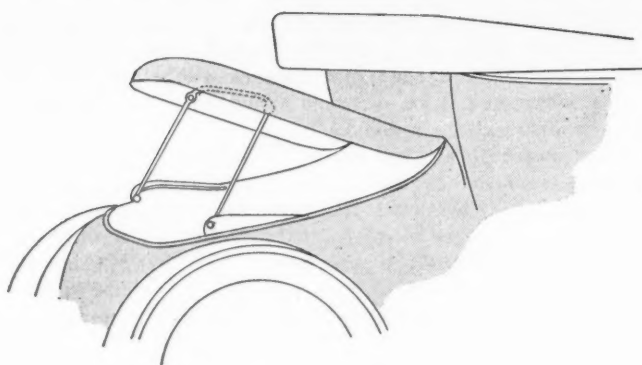


Fig. 4—Runabout deck cover supported by sliding arms

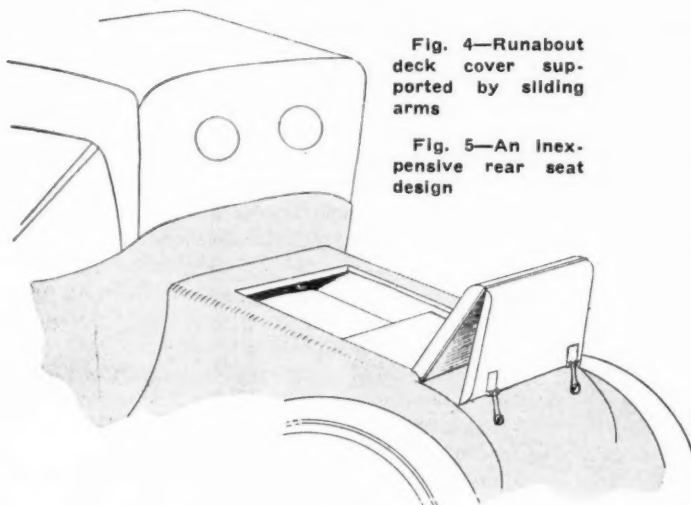


Fig. 5—An inexpensive rear seat design

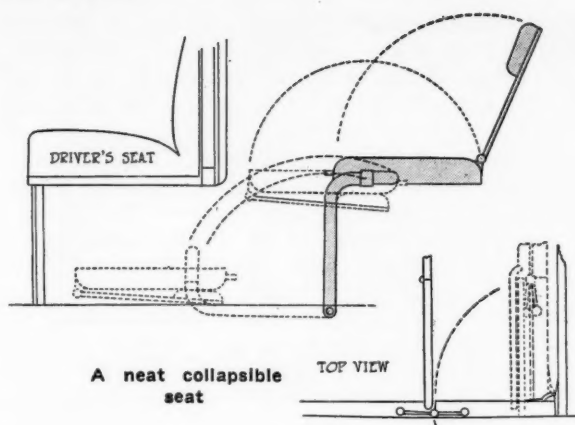
get up from comfortably. The average height inside from floor to under roof in closed bodies is 55 in. One body at the Salon had only 50 in. height and there are several that are only 53 in. Years ago 58 in. was considered the proper height and from present indications 54 in. will be the average height for all stock bodies. The average height of the seat back on touring bodies is 15 in. for the front and 18 in. for the rear.

The instrument boards on nearly all the cars seen at the Palace are similar designs to last year, and though arranging the indicators in this manner gives the car a machine-like look, there is a disadvantage and expense when the bodies are changed, and there was more than one comment that this is a thing that is being overdone and should be made less prominent. One body at the Astor Hotel had the clock and speedometer at the rear of the driving seat and the balance of the indicators on the dash just above the toe boards, this left the cowl free and clean-looking and one felt that it would be easy to enter this body and not bump the shins, although the seat was very low. It is safe to predict that a year hence will see a change in the location and appearance of this feature.

One Person Tops Universal

At the Palace one-person tops were used exclusively, a few touring bodies had victoria top, there were more wire wheels used than last year and the dash lamp was only noticed on two makes of cars, the extra shoes or tires were carried in nearly every case at the rear and there were more guards of the crown type than ever. Fig. 9 shows the Chalmers front and rear guards and the cross-section shows the shape of the top line. The trimming material of the touring and runabout bodies is mostly leather, a few have the imitation and a few Spanish leather with fancy colors. Only one body in the show had the Turkish style of trimming, all the rest had either the straight pipe with few buttons or the older form of pipe and point.

The electrics from a casual glance appeared like the dis-



A neat collapsible seat

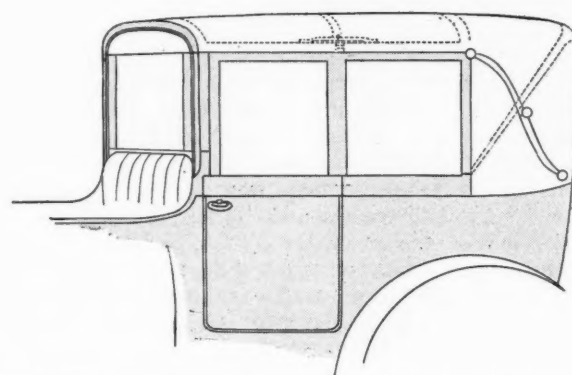


Fig. 10—Healey Holbrook folding top semi-touring car

play of last year, except that there was less conspicuous trimming used inside and more color used in the outside painting.

The closed bodies were modest in design, no job had the full rounded or extreme dip to the roof line, there was a tendency to flatter roof shapes, two bodies had chauffeur lights, nearly all had the double vision windshield and regulators were used on the windows almost exclusively. Several had fancy trimming combinations and some had the broad black and white striped trimming, this was nearly always accompanied by white and black painting on the body and chassis. The coupelet designs were identical with last year and the coupés were all large and had the extension window forward of the door, and room for four inside.

At the Salon there was enough new in body construction to satisfy the exacting and the curious as well as those who are really interested in watching progress. The new bodies were practically all closed ones this year as against previous years when open bodies represented the bulk of the innovations.

The exhibits of Brewster, Healey, Lock, Bender & Robinson and the foreign bodies of Barker & Co., as well as the bodies of the Fleetwood Metal Body Co. and Hayes & Miller Co. all came in for their share of notice. Fig. 10 is a semi-touring body, Healey and Holbrook showing some of this type. The top is fully collapsible and the ease with which

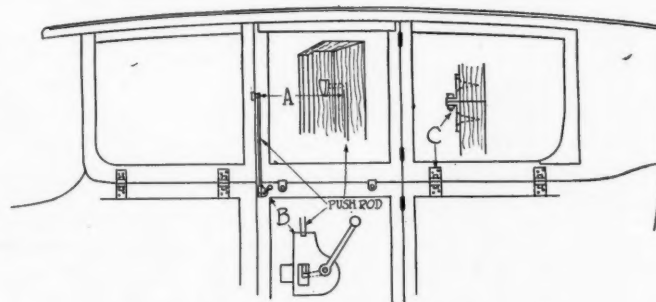


Fig. 6—Diagram of Kissel "All Year" body

one man can operate it was demonstrated at stated intervals on the Healey body at the Locomobile exhibit. At the rear pillar are landau springs to assist in carrying the weight while lowering and raising. The front pillars fold down, and the manner in which the top part collapses is indicated in the diagram plan view; the top is of leather and is lined inside in light grey cloth. The body makes an attractive design, having the advantage of being easily converted into a closed, and open car, or the sides can be entirely opened after the manner of the well understood permanent roof bodies. Fig. 11 is also a Healey production, and has one of the two new folding seats at the shows; the method of operation is clearly depicted in the drawing. Its advantage is that it is folded away horizontally, and the pocket to receive it will not be high enough to prevent the glass in the front division from dropping its full length, as is the case when the ordinary type is let into the partition.

V Windshield Types

Fig. 12 is a V-type windshield Sedan exhibited on the White, it is painted in white and black, and the trimming corresponds; the roof is leather covered and it makes a very neat, compact body that is not too extreme to suit the taste of refined people. There was another V windshield body shown by Holbrook that was larger, and another the Bender & Robinson exhibit on the Singer, this body being very low, as indicated in the drawing. It can be opened (permanent roof fashion) and the roof is entirely of glass, to enable the

occupants to get light from above. This job was the most extreme design at the show, it was finished in good taste, both outside and in, and the right balance altogether gave the body a racy, but not an overdone appearance; for its class it hit the mark and did not shoot beyond.

Figs. 14 and 15 are two drawings of the Fleetwood Metal Body Co. cabriolet on the Lancia. Fig. 14 is the complete design and Fig. 15 shows the operation of folding the top down. The cabriolet is coming into its own as a town car, and while it will never be generally used, it has a class that appeals to the discriminating. This body is painted in yellow, red and black, the top is leather and the trimming light cloth, while the driving seat is black leather. The Barker cabriolet is operated in practically the same way as the diagram for the Fleetwood, but the leather quarter is cut semi-circular to allow the leather to part at the front when the top is thrown back, while the Fleetwood uses a loose flap that is fastened, when up, by glove fasteners. Barker had two cabriolets, one large and one small and both on Rolls Royce chassis. Fleetwood had a touring body on the Lancia that attracted attention on account of painting, this being a green color in which the brush marks are plainly left just as the paint had been spread. The makers use a special

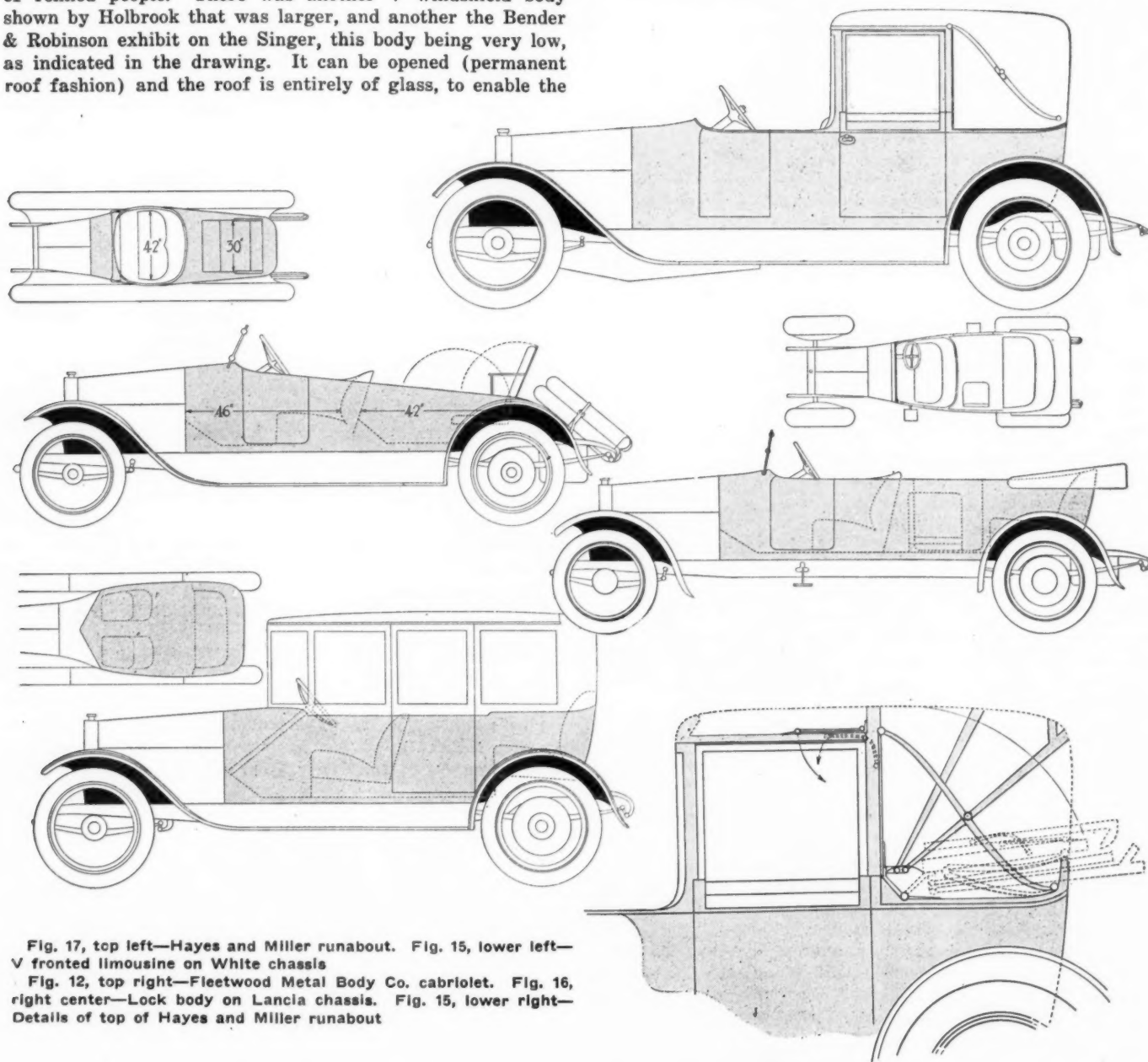


Fig. 17, top left—Hayes and Miller runabout. Fig. 15, lower left—V fronted limousine on White chassis. Fig. 12, top right—Fleetwood Metal Body Co. cabriolet. Fig. 16, right center—Lock body on Lancia chassis. Fig. 15, lower right—Details of top of Hayes and Miller runabout

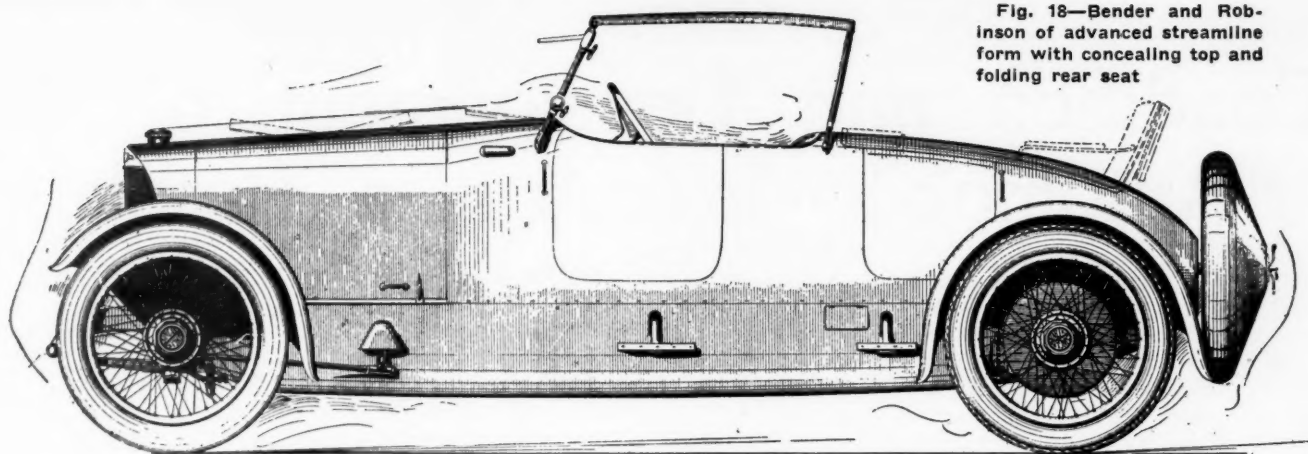


Fig. 18—Bender and Robinson of advanced streamline form with concealing top and folding rear seat

paint that does not need either dryers or varnish; it is applied with the brush and not rubbed smooth; in use, however, it wears smooth and gives the dull finish that has the most durable wearing qualities.

Fig. 16 is the outline of a Lock body on the Lancia. For five passengers, four on the seats facing forward and the fifth on the side seat placed practically on the floor, the occupant sitting across the car. This body came in for much favorable comment, on account of its light appearance and general air of tastefulness in finish and design. The doors are offset as indicated in the drawing, and there is no instrument board used; the clock and speedometer are placed at the rear of the driving seat and the other indicators on the dash board, this giving the cowl a very light and airy look

compared with the majority of the bodies at the Palace show with their ponderous boards under the cowl. The paint was green and inside finish grey cloth, the top of the driving seat was especially good where it joined the side body line. Dome bicycle guards were used and steps in place of the running board.

Fig. 17 is the Hayes & Miller runabout on the Lancia, this job, while not absolutely new in design, being well received by the observing public and it merits all the favorable comment that was passed upon it.

Fig. 18 is another Bender & Robinson creation. It was tastefully painted and trimmed and was one of the few that approached a true streamline in its entire contour. It strongly resembles their larger body.

Good Patents Often Unworkable

By Walter Tibbetts

THERE is an erroneous impression held by a great many people, even among those who are otherwise well informed, that once a patent is issued to an inventor there is nothing whatever to prevent him from proceeding at once to manufacture the entire device or machine shown in the drawings of the patent. This probably comes by reason of the layman considering a patent as standing by itself, isolated, independent of all previous and future patents, a thing having no relation to anything that has gone before, a new creation made out of whole cloth.

On the contrary, it seldom happens that a patent is issued in these days but that the line between it and what is prior to it is so hazy as to require an expert in many cases to define it at all. And frequently a great deal of technical argument before the Patent Office is necessary to convince it that there is a line of demarkation in the case.

Every patent is so closely interwoven with the patents that have gone before it in the same art, that in most instances the device or machine of a newly issued patent cannot be made without infringing the claims of one or a dozen previous patents. In other words, practically all patents issuing from the Patent Office are "improvement patents;" that is, the devices and machines shown and claimed in them are simply improvements upon or changes in the devices or machines shown in previous patents.

Thus a man may invent a valve mechanism for a motor and, while his attorney will probably get an allowance of several claims that will not conflict with the various similar earlier patents to which his attention will be called by the Patent Office, yet it does not follow that his motor is not an infringement upon any of those earlier patents.

This valve mechanism may be arranged in the head of the motor and co-operate peculiarly therewith, which fact may

give it novelty and make it patentable, but he will probably find several earlier patents on similar valves arranged at the side of the motor or elsewhere and containing claims that are broad enough to cover that particular valve construction regardless of its location or co-operation with other parts of the motor.

And even should his valve mechanism be of such nature that it is absolutely new in toto, yet he could hardly build and operate his motor without infringing a number of patents on several of the other essential elements of the motor, such as the carbureter, the magneto, spark plugs, etc.

Of course it does not follow that suit would be brought under all of the patents which such a motor might infringe, or if brought, that they would all be upheld against him, but the fact remains that the new device or machine in nearly every case is simply a step in advance in the art, and is usually anticipated in part at least by some one or more of the clever inventors that have gone before, so that the earlier claims will be seen to cover and perhaps control the later structure.

Obviously each inventor has the like privilege of making his claims as broad as the prior art will permit so that he may also cover the next inventor who comes along with a slight improvement upon his device. He is then in a position to stop the later inventor from making the improved device, and the later man, if he obtains a patent upon his particular improvement, may exercise a like privilege as regards the making of that particular form of the device. Neither of these inventors can make the improved form of the device without the consent of the other.

Of course the earlier patent will expire first and the later inventor may then use everything shown in it, while the first

(Concluded on page 167)

Condition and Development of the Automobile Industry in Russia

By Professor Nicolas Kouznetzoff,
of Petrograd

THE development of automobilism in Russia dates from the first automobile exhibition which took place in Petrograd in 1907. This was followed the next year by another exhibition in Moscow and the last show took place in Petrograd in 1913. This was of a specially great importance to the development of the automobile industry, and the number of cars imported into Russia during 1913 was doubled, being 2000 as compared with 400 the year previous. Every year the Imperial Russian Automobile Society organizes contests which are partly races and partly reliability trials, and these are of great benefit to the business, more particularly because they introduce automobiles to towns and cities where motor vehicles have never before been seen.

In 1909 an automobile regiment was organized in Petrograd, and this was the beginning of military motoring in Russia.

Five Cities Led Before War

Before the war commenced the automobile business was more or less concentrated in Petrograd, Moscow, Kiev, Riga, and Charkow, and the following table shows the approximate sales:

Petrograd	2,600	Riga	600
Moscow	2,200	Poland	1,500
Kiev	1,000	In other States.....	3,000
Charkov	800		
		Total	12,000

In this enumeration the military automobiles are not included and these probably numbered about 1500 at the outbreak of war.

German Cars Were Popular

Concerning the cars tabulated above the majority came from Germany. France ranked next and England had a fair proportion. A good many also came from Italy and a few from America, mainly Ford, Case and Hupmobile.

In the city of Petrograd the most popular car was the Benz, with the Opel ranking second, and then followed Renault, Delaunay-Belleville, Mercedes, Fiat, Metallurgique, Vauxhall, Itala, Rolls-Royce, Peugeot, Lancia, Panhard and a few less known French makes. A certain number of cars are also turned out at the Russian factory in Riga.

No Real Automobile Dealers

Trade conditions in the automobile business in Russia have been very unsatisfactory, owing to the absence of agents or dealers as understood in America. Many good firms were represented by people who regarded automobiles as a side line and the general poor state of affairs led to the establishment of manufacturers' depots in Russia during the two years previous to the war. Much of this activity was the result of German farsightedness, as may be shown by the example of the Benz company who opened a branch in the



Prof. Nicolas Kouznetzoff

best part of Petrograd, adding repair shops. The rent for the building amounted to \$12,000 a year and at the outbreak of war an excellent business was being done. The first year more than 400 cars were sold and large inducements were offered to the clients. Another branch was situated in Moscow and was also doing a very good business indeed.

Almost as good a trade was being done by the Renault branch in Petrograd although the sales were slightly smaller than those of the Benz. In 1914 Renault actually commenced to build a factory in Petrograd, intending to manufacture cars on the spot, but of course this is at present operating on the manufacture of munitions.

Among other well known manufacturers having depots in Petrograd may be mentioned Mercedes, Delahaye, Fiat, Metallurgique and Vauxhall.

American Car Prices Exorbitant

Concerning American cars in many instances the Petrograd agent represents several different manufacturers. For example, the Ford and White are handled by M. Fride, while Plum & Oxs sell Cadillac, Hupmobile, National and Saxon. M. D. Mikailovsky & Co. have the Chandler and Metz. Case, Chevrolet, Detroit, Franklin, and Mitchell have individual representation.

The sale of American cars in Russia has been restricted by the extravagant prices asked and by lack of proper advertising. A Ford car in Petrograd costs \$1,187.50. Of this amount the freight and import duty amounts to about \$300 in normal times, so it is easy to see that an extravagant profit is obtained somewhere. Another trouble is that many of the agents carry an entirely insufficient stock of spare parts and a man hesitates to buy a car knowing that a replacement may take from two to three months to obtain from America.

7500 Cars and Trucks Needed

Notwithstanding the unsatisfactory condition the Ford has sold extensively, the agent being credited with a turnover of more than 1000 cars per year. It can be stated positively that during the first year after the war Russia will need more than 6000 passenger cars and not less than 1500 trucks. After this it is expected that the annual demand will increase at the rate of 100 per cent each year.

Many people are unaware of the existence of the Russian-Baltic factory of Riga, which has been producing railroad cars and commenced the manufacture of automobiles in 1899. The factory has been favored by many large government orders and at the start of the war was building complete cars without the need for importing any parts. Its estimated output for the past few years is between 300 to 500 cars annually and its most recent program consisted of two models of passenger cars. Only experimental trucks have

been built and the work of the factory must have been somewhat interfered with by its transference from Riga to the interior. At present, the entire output is taken by the government for war purposes.

No Large Car Builders in Russia

It is perhaps surprising that the number of cars used in Russia should be so small, but the situation is explained by the paucity of state roads and the unsatisfactory conditions of sale which have been described. It may also be due in part to the absence of any large automobile manufacturing plants in Russia. At present there are only 22,000 miles of state roads in all Russia. They are situated mostly in places where they have a military value such as the western part of Russia, in Poland, in the Caucasus and in the state of Moscow. In addition to these principal state roads there are country roads aggregating about 135,000 miles, and these are quite satisfactory in summer. In the spring and fall the majority of the roads are impassable, although all-year traffic is possible on a few. The reason for the roads being so bad is that the money available for their improvement has been insufficient. It has absorbed the attention of the government to develop the railroads, but the Duma has been devoting attention to roads recently and it is expected that the state road system will be extended very greatly soon after the war.

Less Than \$5,000,000 Yearly for Roads

At present, for building new state roads and repairing old roads there is an annual appropriation of less than \$5,000,000 and two-thirds of this is given to the roads having military importance. This, of course, leaves but a small sum when one regards the vastness of the road system really required by Russia. As a comparison, it is interesting to observe that the State of New York last year voted nearly three times as much money to roads as does the whole of Russia in a normal year.

The use of automobiles in the war will undoubtedly result in their value being appreciated much more widely and there is, therefore, every reason to anticipate that the building of new state roads will proceed very rapidly when the war is over. The ministry of ways of communications has already worked out a scheme for a complete system of state roads interconnecting with new railroad lines.

Cars Taken for Army

Harking back to the start of the war, one of the first problems of mobilization was the necessity of equipping the army with a proper quantity of automobiles. The first step taken was to issue an order appropriating all private cars and almost every one of these in addition to every truck was taken for the use of the army. In this manner about 3000 passenger cars were collected. The majority of firms which used trucks for handling their product were left entirely without means of transportation.

America Has Contracts

In addition to this appropriation of all trucks in the country the Russian war de-

partment sent a special commission to London and there purchased all the trucks it could get at that time, also ordering some American cars and motorcycles through the London agents. The European supply was soon exhausted and at present America is the only country holding war contracts for motor vehicles for Russia. The largest American orders have been given to White, Packard, Pierce-Arrow, Peerless, Locomobile, Jeffery, Garford and Federal.

Large Market Expected After War

At the end of the war there will be a very large market for motor trucks in Russia. In the last two years trucks have been used to an increasing extent in the principal cities. The types mostly desired for Russian use are 5- or 6-ton trucks which are required for city service and light trucks of from 1½- to 3-ton capacity for the country. It seems reasonable to assume that Russia will look to America as the principal supply of automobiles and there is no doubt that America can grasp this great market if it will only act quickly. After the war German competition will be renewed and will be extremely keen so it is necessary that the American manufacturers should make a concerted effort properly to establish themselves in Russia.

American Cars Popular in Russia

The matter to which the American industry needs to give the closest attention is that of securing proper sales representation and it is the opinion of the writer that success can only be hoped for by means of establishing American-owned and managed sales and repair establishments throughout Russia. At present American cars are popular in Russia because they are better able to withstand bad roads. Plans should be proceeded with immediately, since now is the time to establish the American industry in Russia. There is much to be lost and nothing to be gained by waiting until the war is over.

A Truck-Factory Opportunity

Another great opportunity for American industry is to erect a truck factory in Russia itself. Shortly before the war French, German, and some British automobile manufacturers were planning to build factories near Petrograd or Moscow, and there is no doubt these intentions will be carried out. An American concern intending to manufacture in Russia would be able to commence operations immediately. Of course it is a truck factory which is most urgently needed. A law is expected to be passed which will subsidize automobile trucks modeled on the German system which will encourage the purchase and the use of trucks. It is obvious that those who are first in solving the problem of giving Russia an adequate supply of commercial vehicles will obtain the largest orders at the earliest moment after the war is over.

Let it again be said that the opportunity is at its best just now, to wait for another year in order to see how things are going is to lose a substantial amount of advantage when the big orders come along.



A graphic illustration of the area of Russia in Europe as compared with the United States and giving an idea of the possible automobile and motor truck market which it is expected will be opened to American manufacturers at the close of the European war. In addition, it must be remembered that Russia in Asia represents a much larger territory than that illustrated, although there is a comparatively small population.

Electric Efficiency Improved

Better Engineering Keynote of 1916 Electric Passenger Cars— Lower Weight and Improved Electrical Parts Give More Miles per Charge

THE keynote of progress in the electric passenger vehicle field during 1915 has undoubtedly been better engineering as indicated in the many refining touches, greater standardization and factory economies in production, all of these making possible considerable price reduction in nearly every case.

It has not been easy for the manufacturers of a product, heretofore regarded as a thing to be marketed only in comparatively small quantities to a leisure class and to the feminine element, to cut production cost without in any way curtailing quality. In most manufacturing activities it is the rule that unless quantity of output is greatly increased it is impossible to lower price without sacrificing the qualities for which the electric must always stand. But it has been done, and by the strictest attention to design the new models are in every case better. It has meant much for one of the leading makers to bring down prices averaging \$700 on all models, and for another to lower them \$150 to \$200 per car, but they are signs of the times. They have materially increased their outputs, in one or two cases actually doubling their manufacturing schedules.

Weight Cut in Many Cases

Weights have been lowered in many instances, models almost alike but heretofore differing in only a few details have been standardized so as to use the same chassis wherever possible, batteries have been lessened in weight at the same time that they have been increased in capacity, motors have been improved so as to draw less current, and these latter influences have had their effect upon the greater mileage of the cars per charge. The need of absolute silence has been still further recognized, and all have come to some form of silent axle gearing—in most cases either spiral-bevel or a worm gear type. Speed has been increased so that many cars will now attain a maximum of 30 m.p.h., which is more than ever needed within the city limits, although a feature of advantage for suburban going. The need of lubrication attention has been minimized as well as care of batteries, these being factors which cannot help but appeal. In short, much has been accomplished in a few months, and the electric industry to-day is on a better basis for success than ever before.

Few Startling Changes

Thus while no sweeping changes have been made by anyone, a better all-around vehicle has been evolved as a result of the general refining process that has manifested itself, not in any one part of the chassis only, but here and there throughout the whole car. In a few instances a large part such as an axle or a type of motor has given way to a different construction, but this is rather the exception than the rule. Most of the changes have been of a refining nature.

A more general use of aluminum for the body panels and fenders has been the rule, and this has had its effect upon lightening the cars. Another factor for lightness has been quite a wide adoption of stampings and forgings to take the place of castings, one of the leading makers effecting a

considerable saving in this way, while at the same time strength is increased. In making such a change as this, however, much depends upon the facilities of the factory and the volume of the output, for it would obviously be impossible to go to the great expense of making dies for forgings and stampings unless the quantity of the output would warrant it. Here again is an instance of the advantage of larger output, for once the preliminaries are over, it costs less to use forgings and stamped parts than castings and they are more desirable.

Batteries Are Lighter

Another point of attack has been the battery, and in a number of cases weight has been lessened by redesigning the cells. One prominent maker has succeeded in cutting 50 lb. from the weight of the battery and at the same time the capacity has been increased. On the whole there has been little change in the mileage possibilities of the cars, many of them having been for a year or more capable of close to 100 miles on a charge, and this seems to be all that could be desired.

Of all types of vehicles on the market, the electric must be the acme of silence, and one of the points at which much attention must be focussed in order to bring this about is the rear axle. Since the spiral-bevel type of gearing has become so extensively used with such great success the worm-driven axle which has enjoyed high esteem among the electric designers, has encountered a serious competitor, and the list of designs of electric cars now on the market are now about evenly divided between the two types of final drive. One of the largest producers has come to the spiral-bevel within the past year, although still offering the overhead worm optionally. There are many designers who do not take kindly to the worm drive where they can get something else that equals it in the matter of silence. There is one big advantage of the worm however, that must not be overlooked, this being the fact that it gives a bigger reduction between motor and driving wheels than is possible with a single-reduction spiral-bevel axle. This means that the motor may run faster for a given speed of the car, and it can as a rule be smaller. However, so far as this point is concerned, and considering the current consumption, the advantages of one drive about offset those of the other.

As between the underneath and overhead worm types, there are about as many adherents of one as the other. Better oiling of worm and wheel is claimed where the worm is below, but such construction obviously reduces the road clearance and puts the drive shaft at a greater angle to the horizontal. Either of these may or may not be objections. In most of the designs using the underneath worm there seems ample clearance for average city work, and in fact any reasonable road surface, and there is no difficulty in attaining a straight line drive between motor armature and worm, it being simply a matter of supporting the motor at an angle to correspond. Adherents to the overhead worm have obviously overcome any oiling difficulties that may have been present in the earlier types, so that the position of the worm simply

resolves itself into a consideration of which lends itself best to any particular chassis installation. Generally speaking, it would seem that the overhead worm type would lend itself to simplest installation, although this remark will not apply to every case.

Lubrication Improved

One refinement that is of special advantage to the car owner is the method of lubrication. There is a more general use of self-lubricating bushings, these doing away with a multiplicity of oil or grease cups. In thus reducing the number of parts demanding lubrication attention the cars have taken a decided step forward, for with the electric perhaps more than with the gasoline car the owner is less in touch with the mechanism, relying more on the garageman, and a reduction of the points for lubrication has an obvious advantage from this standpoint alone. This attention to grease cup reduction is more especially to be found in the steering mechanism, and this is a factor for greater safety since it allows of less attention to these parts without detrimental result. At points where grease cups have been applied, there is a tendency to make them more accessible, and in more than one design there is not a single grease cup beneath the car.

Turning to less mechanical aspects of the electric of to-day, it is at once noticeable that designs are being brought out which are more masculine in their appeal. Heretofore the electric makers have almost overlooked the fact that while their product is especially desirable to meet the transportation needs of the lady, it also can be made to fill a very important place with the business or professional man. Being dependable at all times, and usually equipped with solid tires, it can be relied upon to get the business man to his destination without delay, and can wend its way in and out of traffic with the least trouble in starting and stopping. Now that speeds as high as 30 m.p.h. and over are attainable, the manufacturers have awakened to the possibilities of selling mannish roadsters to the city man. Hence a large number of these have appeared and are meeting a popular demand that might well be increased with aggressive attack upon this hitherto neglected class of possible buyers.

Cars Have Better Bodies

Externally the cars are even better to look upon. The impression is given by the new designs that the fenders, running boards, battery hoods and bodies are more of a unit, this being gained by the better and more substantial mounting of all parts. The domed fenders which seem to be consistent with the general curved lines of the bodies are attached much more rigidly than they used to be, and they have larger skirts to help in this direction. With the extensive use of aluminum panels, it has been possible to make the battery hood sides of the same sheets that form the body also, since it is possible to handle the large sheets of this material satisfactorily when hammering them to the proper shape, and for other reasons of unity, substantialness and appearance. In most cases, the corners have been very pleasingly rounded and the hoods blend into the bodies to prevent any suggestion of a break between them.

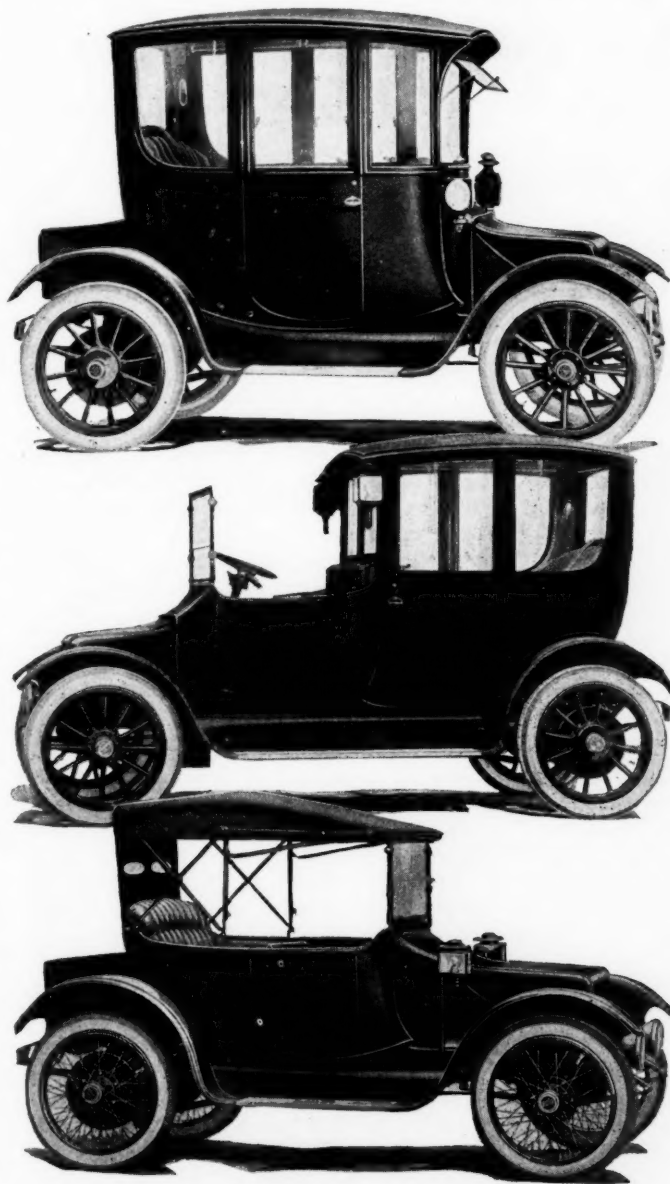
There is little to be said regarding the interior appointments. It is difficult to imagine more elegance in upholstery, interior finish or fittings than the average electric possesses and aside from some rearrangement of the seats, better upholstery and more comfortable angle to seat backs in certain instances, there is little alteration over the designs of the previous year. If there are any discrepancies in the modern electric vehicle, they are most certainly not to be found in the interior finishing or fittings.

To give more capacity to batteries, there are several instances where this has been done by adding plates to the cells rather than by increasing the number of cells. At the same

time motor efficiency has been improved so that in general the cars operate to a greater distance on a charge, if there has been any change in this respect, due to a combination of greater battery power and less current draw by the motors.

Realizing the need of better maintenance facilities in order to increase the use of electrics and breed satisfaction among present users, there has been a widespread movement among the electric men during the past year to afford better service along with cheaper rates for charging. This tendency was boosted by the opening during last summer of the new co-operative electric garage of the New York Electric Vehicle Association. This is now housing its full quota of 100 cars, and the equipment of this station, which is the largest in the Metropolis, is unusually complete, having facilities for charging from 100 to 200 cars per day and to care for the various sizes and types of batteries. With this as a germ, finely equipped electric garages are springing up in greater numbers all over the country, and in some instances going even farther and give a free parking service during the day-time. In Chicago this feature is of greatest value for in the congested Loop district it would be almost impossible to use the cars intermittently without some place to put them temporarily when at the theater, shopping, etc.

In the matter of battery rental much has been done within the year with the Walker Vehicle Co., the pioneer. Now



Three Baker R and L types

operative only in Chicago, this scheme has proven successful, and it consists mainly of selling the car without battery if desired, the car owner renting a charged battery for a certain amount monthly. Other private garages have taken it up, and the industry as a whole is very much interested in the plan. We may expect to see it materially increased in its scope and adoption within another year.

Detroit's Refined and Cheaper

Although many minor mechanical changes and little improvements in the bodies of the Detroit Electrics make them better cars than those they succeed, the feature of the Anderson Electric Car Co.'s activity at this time is the large price reduction of all models which is made possible by a practically doubled production as compared with one year ago. The Detroit's now sell at prices ranging from \$1,975 to \$2,275, which means reductions running from \$600 to \$725, depending upon the model.

The 1916 Detroit list includes six body types:

Model 61, four-passenger brougham, price reduced from \$2,600 to \$1,975.

Model 60, five-passenger double-drive brougham, lowered from \$3,000 to \$2,275.

Model 59, rear drive, five-passenger brougham, price lowered from \$2,950 to \$2,225.

Model 58, front drive, five-passenger brougham, lowered from \$2,950 to \$2,250.

Model 57, four-passenger inclosed type, cut from \$2,850 to \$2,175.

Model 56, three-passenger cabriolet, \$2,650 formerly and now \$2,075.

There is nothing changed in the basic construction of any of these models, as they continue to use a 4-hp. series-wound motor with shaft drive to the rear axle, and a forty-two-cell lead battery equipment. For the rear axle there is an option of either the standard type of worm drive used in 1915, or a floating spiral-bevel rear unit with a reduction of 6 to 1. There are, however, a number of refinements that tend toward great interchangeability of parts throughout the line of bodies, and to even better body work, performance and convenience.

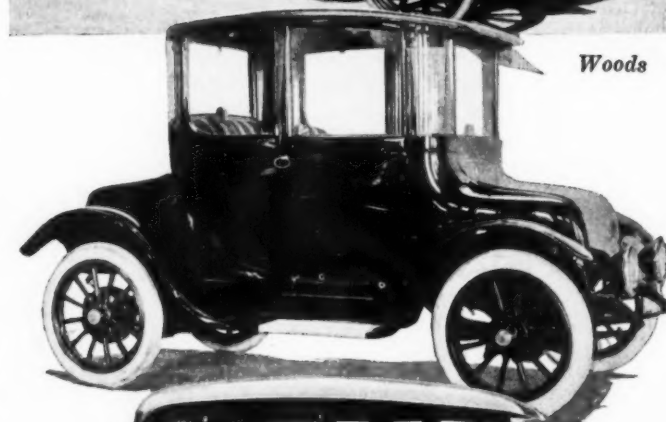
Among the mechanical details that have been improved is the redesigning of the current cut out in order to adopt the more efficient knife-blade type of switch. The box containing the cutout has a removable cover for inspection purposes. Besides this, the taking out of two screws allows the removal of the bottom of the box, to which the contacts are fastened. Thus the container of this important unit has increased accessibility, is simplified and greater proof against wear.

As a factor for reducing the weight of the cars in many points throughout the chassis, castings have been replaced by stamping and forgings, these also increasing the strength. Weight has also been cut from the battery to the extent of about 50 lb., this despite the increase in capacity. Another point of weight reduction is in the rear axle, and the sum total of all this better designing is a chassis which is 150 lb. lighter than its predecessor. Refinement has also been brought about in the brakes which now have one-piece shoes lined with a better braking material, this resulting in not only more positive action but also in increased life of the lining. The new chassis also shows a more general use of self-lubricating bushings and a reduction of the number of parts requiring lubrication attention. Looking to greater conservation of power the wiring has been rearranged to give a shorter distance for the current to travel, hence less voltage loss.

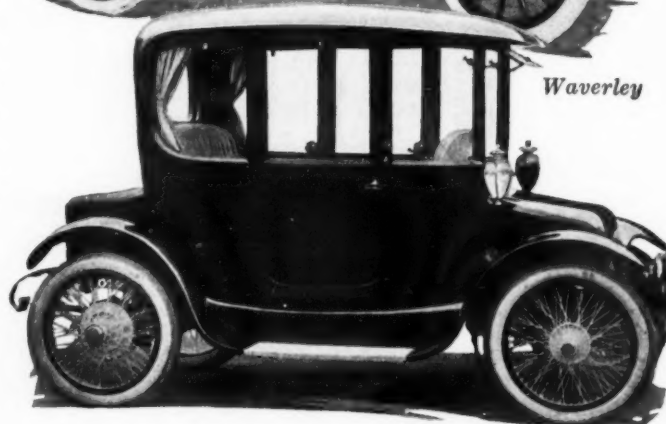
Wherever it has seemed possible to do so the seats have been made more comfortable, this particularly applying to the Model 57 whose rear seat is deeper and which has a new and more comfortable arm-rest. Doors in this model have also been widened.



Woods



Waverley

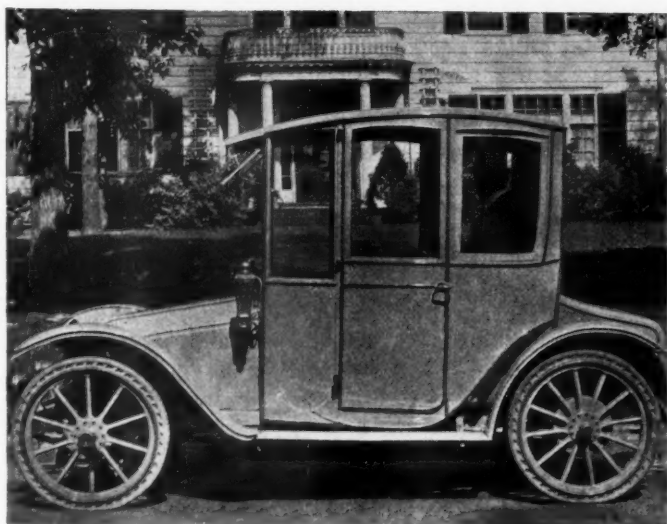


Ohio

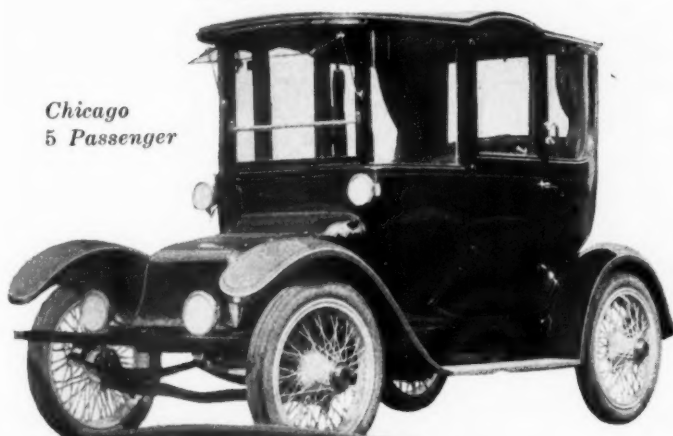
Baker, Rauch & Lang Prices Lowered

Nine models are listed by the Baker, R. & L. Co., and although none of these is totally new, each is an amplification or improvement upon its predecessor. They chiefly differ in that they have a higher-speed motor, a larger motor brake and a number of minor improvements that help to produce greater ease of operation and greater comfort. Price reductions have been made on some models. The roadster and the club roadster remain at \$2,600 and \$2,800 respectively, but the brougham is \$150 lower at \$2,800. The coach and Baker brougham both now sell at \$3,000 instead of \$3,200. For this season the Baker car will be confined to this brougham known as BBD 6 which is a double drive model and to the DA 6 coupé which sells at \$2,475. The other models will carry the Rauch and Lang name.

Mechanically there has been few changes except those which another year's experience dictate. The battery equipment in all models remains the same and is eleven MV Hy-Cap Exide, forty-two cells in the larger cars and forty-one cells in the lighter types with the exception of the Baker coupé with thirty-six cells. Mileage per charge has not been



Hupp-Yeats worm drive type

Chicago
5 PassengerWard
Coupé

altered and Baker calculated this to be from 50 to 85 miles according to conditions and the driver. Mainly the aim has been to still further promote ease of control, freedom from adjustments and safety. These cars use a worm drive rear axle which is said to have proved exceedingly satisfactory after long service. Silence is especially the result of this axle combined with the light-weight, high-speed motor.

A shorter turning radius has been secured by narrowing the chassis at the front end. There are four different wheel bases to conform to the different body types. The two town car models have 109-in. wheelbase, the roadster types and two of the broughams are 92 in., the coach and the Baker brougham 102, and the Baker coupé 90 in.

On the Rauch & Lang models an ampere hour meter has been added as the central feature around which is grouped the ammeter, voltmeter and the speedometer. These accessories have been well located in a unit with sufficient illumination to make them readable under all circumstances.

Altogether the changes make for convenience, and for the comfort of the driver.

Waverley Concentrates on One Model

A policy of concentration upon one model has been decided upon by the Waverley company. This is designated as Model 110 and takes the place of all previous Waverley types. This car is entirely new throughout, both in body construction and body features. Briefly the specifications of the new chassis include forty-two cells of eleven-plate lead battery of either Exide or other standard make, series-wound motor which drives through an open shaft to a spiral-bevel type of rear axle, with Hotchkiss drive principle employed. The wheel base is 95 in., with tire equipment 32 by 4 in. pneumatics or 34 by 2½ in. cushions.

It is a point of special note that the weight of this car is fully 1000 lb. less than that of any of the 1915 Waverley models, thus indicating the engineering refinement which the new chassis has undergone. To make maintenance as simple as possible spring lubrication is through self-oiling bushings without grease cups underneath the car.

The speed and mileage are practically the same as last year, the improvements in the engineering features being chiefly in the production of a light-weight model, while still preserving the roominess of a four-passenger car. The reduction in weight and the greater simplicity of the construction have made it possible to reduce the price to \$2,150 when the body has an offset rear seat, and \$2,200 where it is fitted with four separate chairs. The former seating arrangement accommodates three people on the rear seat and one on the forward seat. The body has metal panels and rounded corners with sashless windows and automatic window lifts.

A mechanical change is the mounting of the body on a pressed steel frame, this differing from the previous construction in which the mechanical parts were attached direct to the body. Long three-quarter elliptic rear springs are used. To make for safety of operation of the car, the new drum type of controller has an interlocking shift at the top of the controller core.

Ohio Continues Practically Same Models

There is nothing radically new in the 1916 Ohio cars, product of the Ohio Electric Car Co. The concern is continuing practically the same models as it was building last year with only those refinements which another year's experience in manufacturing makes possible. The Ohio special magnetic control is retained just as it was, having been a feature of cars of this make for several seasons.

For those who desire a large five-passenger car Ohio still builds its double-drive brougham Model 62 at \$3,250. The other prominent models are a single-drive brougham, Model 42 which accommodates five and sells for \$2,900; and a four passenger coupé, Model 12, \$2,400.

The Ohio company was a pioneer in the double-drive type of car and brought out its first models with this feature in 1912. In its construction there are two separate sets of controller mechanism, one in front and another at the rear seat, either operating the car independently of the other. The controller itself is of distinctive design with the different speeds attained by turning a compact hard rubber disk at the side of the small controller head. Steering is by the conventional lever. Four forward speeds and three reverse, the magnetic brake and the warning signal are all operated from this controller head.

Standard battery equipment in all models is the same as it was with the Model 42 brougham having forty-two cells and the double-drive car forty-four. The speed of all the models has been increased so as to give any desired speed up to 28 m.p.h. at a maximum. A very ingenious feature of the transmission unit is the supporting of the torsion tube between the motor and the rear axle at a point very near to the center of inertia, with the idea of putting all the weight of



Two
Milburn
Models



Broc

these members on the frame and above the springs so that they are sprung weight, thus effecting a saving in tires and reducing the required power while at the same time a greater factor of safety results.

Ohio coach work is exceedingly well carried out and the various parts such as battery compartments and fenders seem to have a pleasing unity with the body itself. The bodies are all of aluminum as well as the fenders which are hand hammered. As an example of body refinement, the hinges are concealed and there is an absence of moldings which is made possible by shaping the entire body as a single panel instead of joining the various sections together as in the past; thus following gasoline practice.

Argo, Borland and Broc Unchanged

The American Electric Car Co., continues its three types of electrics known as the Argo, Borland and Broc. Under each of the three names, three models are listed. The Argos are a forward-drive brougham at \$2,800, a rear-drive brougham at \$2,650, and a rear-drive roadster at \$2,350. All three chassis are the same excepting that the forward-drive brougham has a slightly longer wheelbase than the other two. Forty cells of eleven-plate Exide battery are furnished with either car, this supplying a Westinghouse series-wound motor located on the rear axle and driving through a combina-

tion of double reduction herring bone and bevel gears.

The Borland models are not the same as the Argo types, the most important difference being in the use of a double-reduction by a silent chain to the propeller shaft and bevel gears in the rear axle. All three Borland chassis are the same except the wheelbase on the forward-drive limousine, seating seven and selling for \$5,500, is 123 in. in length, whereas the other two models are 96 in. There is a rear- or forward-drive coupé for five at \$2,550, and a two-passenger roadster at \$2,250. Steering is by wheel except on the coupé which has a lever.

The limousine forward drive model is equipped with forty-two cells of eleven-plate Exide battery with a complete installation at the front. The roadster has forty-two cells of eleven-plate type equally divided between front and rear, and in the coupé there are forty cells. In these models a G. E. series-wound motor is used and both sets of brakes are operated by pedals and act upon the rear wheel drums.

It is in the Broc models that the greatest standardization appears as all three are broughams on a standard 96-in. chassis. These models are a rear-drive at \$3,100, which seats five, a double-drive also for five at \$3,200, and a four-passenger, front-drive type at \$3,150. The drive system is somewhat similar to the Argo, with the motor a series-wound Westinghouse hung centrally in the chassis, whence it drives by a shaft to a double-reduction combination bevel and spur gear floating axle. In all three the battery equipment consists of forty cells eleven-plate Exide. Braking is quite different from the Argo and Borland cars, in that one set is on the drive shaft and operated by lever, and the pedal set acts upon the rear wheel drums.

Milburn Adds a Brougham

Besides continuing its Model 15 chassis with roadster and coupé bodies the Milburn Wagon Co., which though long in the vehicle manufacturing business entered the electric vehicle industry a little over a year ago, is offering a brougham at \$1,585 on a new Model 22 chassis. The continued models have been unchanged in construction and sell for \$1,285 as a roadster and \$1,485 as a coupé. Comparing the new chassis with the earlier design, the chief differences are in the wheelbase, which for Model 22 is 105 in., and for Model 15, 100 in., in the battery equipment which for the new chassis has two more cells than the older type, and the tire equipment which is 32 by 3½ in. as compared with 30 by 3½ in. on the Model 15. The new car has twenty-two cells of seventeen-plate W.T.X.I. type, whereas the other model has twenty cells, fifteen-plate W.T.X.

In these cars which have as their chief features comparatively light weight and low cost simplicity is especially apparent throughout. New to electric construction previous to being taken up by Milburn, is the cantilever spring suspension used both front and rear on the Model 15, and in the rear only on the newer car. G. E. motors are used, and the drive shaft is inclosed within a torsion tube and is very short due to the location of the motor considerably back of the center of the car.

An excellent straight-line drive is had by mounting the motor at the same angle as the shaft, which terminates in an underneath worm-drive axle with a direct gear ratio of 9.75 to 1.

Body work is excellent and reflects the long experience of the Milburn concern in the vehicle business. The battery compartments front and rear are made with the same panels that form the sides of the body proper, and there is an unbroken curve between them. Sashless windows are employed, and fenders are crowned and well fitted. Wheel steer is used on the roadster, but the inclosed cars have the usual handles.

The new model is capable of slightly higher speed than Model 15, due to its larger battery and motor. On the third notch, Model 22 attains 18 m.p.h., whereas Model 15

gives 16¼ m.p.h. Treads are 50 in. for Model 15 and 52 for Model 22.

Ward Coupé a New Design

Quantity output has made it possible for the Ward Motor Vehicle Co., to market an entirely new coupé at \$1,295, which is the lowest priced car of the kind on the market. The one model constitutes the line, and it supersedes the coupé which last year sold at \$2,100. An unusual feature is that the entire forty-two cell, nine-plate lead battery is placed under the front hood, giving the car somewhat the appearance of a gasoline type. With this novel body arrangement, four to five passengers can be accommodated on the wheelbase of 88 in. The body length, glass to glass, is 74 in.

The car has a conservative mileage rating of from 35 to 45 miles, attaining a speed ranging from 12 to 15 m.p.h. From the motor, the power is transferred through a single propeller shaft to a spiral-bevel rear axle. A pressed steel frame is used, and spring suspension is by semi-elliptics front and rear. Tires are 33 by 4 pneumatic on demountable rims.

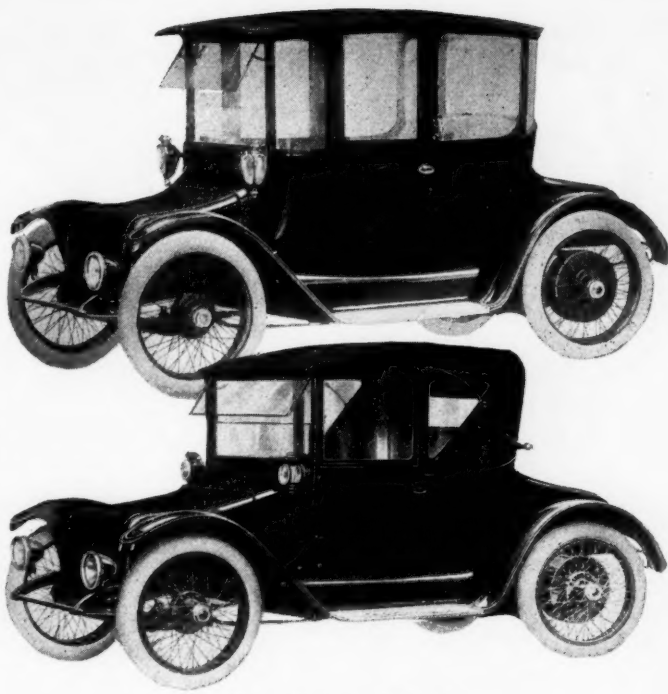
The body construction is attractively worked out so that the same panels of hammered metal that form the sides also integrally include the battery compartment. Interior finish, includes plate glass windows, grey silk curtains to match the grey upholstery. At the price, the equipment includes such items as odometer, locks for the doors, chorgometer, thermometer, electric horn, and tools.

Two New Chicago Models

Two new models, termed the Edison models, are now on the market as Chicago electrics, made by the Walker Vehicle Co. These are designated as Models 162 and 163, and they are equipped with Edison battery as standard. They also carry the new Chicago body design which is representative



The great luxury of the interior of electric cars is well shown by these three views. The upper is of a Detroit electric, the center view a Waverley and that on the extreme right a Baker R. and L.



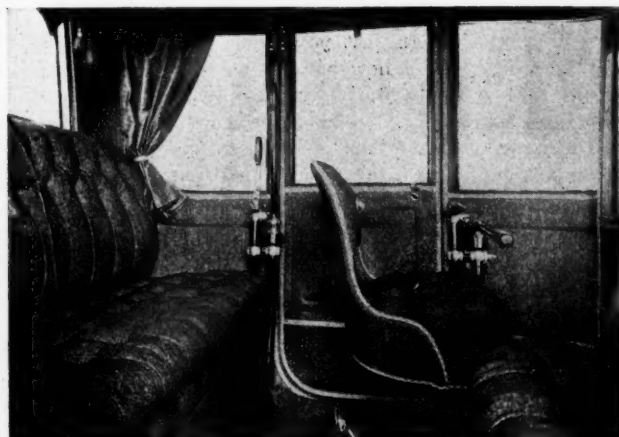
Two Detroit Models

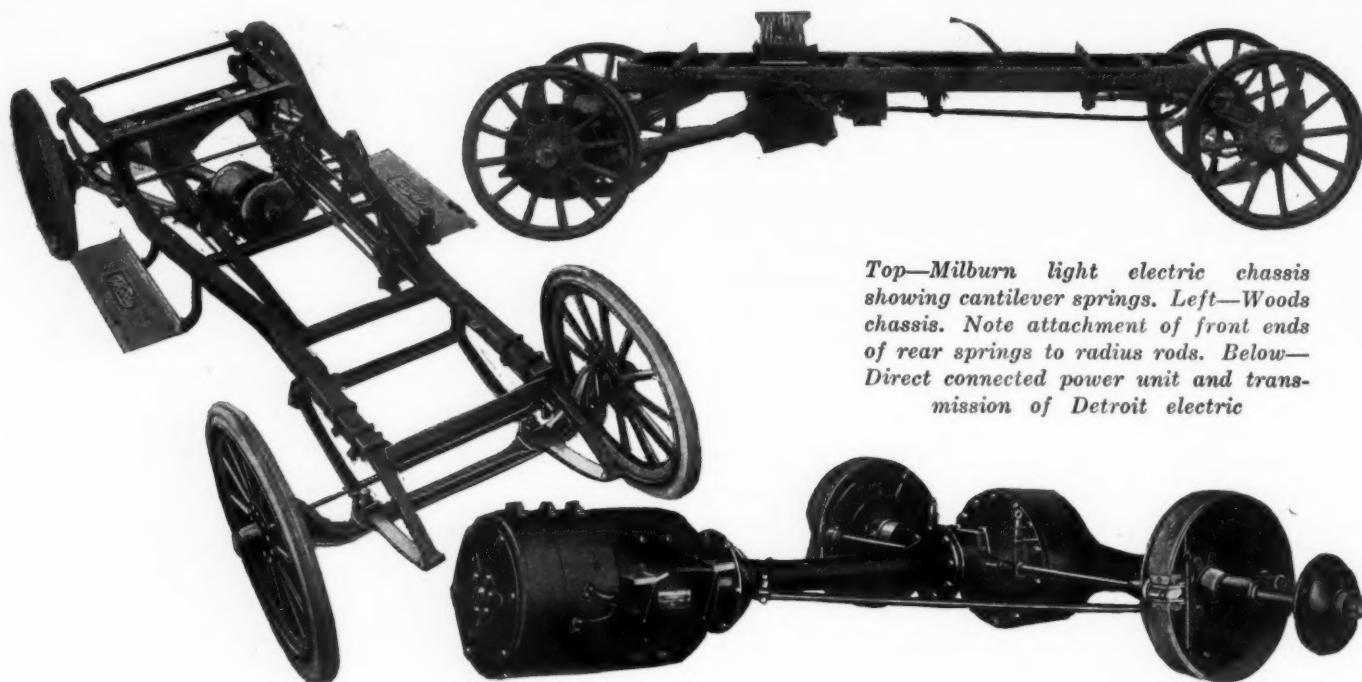
of the latest ideas in electric car construction, and although built along conventional lines, it is low hung and has a long effect. All angles and sharp corners have given way to graceful curves. The arched doors have been modified, as compared with previous Chicago types, to give a straight line roof with only a slight arch perceptible over the door.

Many structural improvements have been added, these particularly with a view to the use of solid tires, for it has been found that more strength than ordinary carriage building affords is necessary in the electric car when solids are used. Aluminum also plays an important part, as it is employed for all parts exposed to the weather.

To long running boards are attached the new crowned fenders which are fully skirted to the bodies. Improvement has been made in the window lifting mechanism for operating the sashless glass, and by different positioning of the revolving seats they are made more comfortable and accessible.

Model 163 is a four-passenger rear seat drive car which has an emergency seat for a fifth, and it sells for \$2,835 with a sixty-cell, G 7 Edison battery and \$2,185 with lead battery. On this chassis, which has a wheelbase of 96 in., there is also built a cabriolet roadster body, and with the Edison battery equipment above mentioned it costs \$2,535, as against \$1,885 with lead battery. On the Model 162 chassis,





Top—Milburn light electric chassis showing cantilever springs. Left—Woods chassis. Note attachment of front ends of rear springs to radius rods. Below—Direct connected power unit and transmission of Detroit electric

with its wheelbase of 104 in., is fitted the new front seat drive, five-passenger limousine. As compared with the other bodies of the line, this averages 8 in. greater length and the seats are a trifle wider. The cost of this car with the Edison battery is \$2,925, and with lead cells, \$2,275.

The same general construction is followed in both chassis, and while building the frame into an extremely rigid unit to take care of the solid tires has been featured, careful study has also been centered upon proper distribution of the weight. Particular improvement is noted in the reduction of the necessary points of lubrication, especially the steering mechanism. Bronze bushings of long wear possibilities have been still more extensively employed than in previous models.

The motors are larger than previously and designed for heavier duty. They are the slow-speed, series-wound type and are coupled up with spiral-bevel rear axles, which were also used last year. The controller system consists of five forward and reverse speeds with brake operated by a horizontal control lever, this being a 10-in. contracting band acting on the propeller shaft.

The Walker concern is one of the pioneers in the adoption of a battery rental system for passenger electrics, and offers all purchasers in the city of Chicago, which is the only center in which it as yet has the scheme in operation, a reduction of \$270 from the list prices when they elect to adopt this method of battery maintenance.

Woods Power Battery Increased

The 1916 series of Woods electrics, which are made by the Woods Motor Vehicle Co., are improved continuations of the models carried through last year with the exception of the Model 1524 which is a new car with a seating capacity for five and selling at \$2,900. The leading model of the line, however, is Model 1522, which is practically the same as it was, and in general the body designs are similar to the 1915 types, but brought up to date in the matter of shape and appearance. Prices of these improved cars are the same as previously, Model 1522 being a four-passenger vehicle at \$2,850, and having a wheelbase of 100 in., and in addition there are three other designs designated as 1501, 1503 and 1504. These latter all have a wheelbase of 110 in. and differ from one another mainly in the arrangement of the controlling levers, the first being a dual control at \$3,100, the second a front control at \$3,000, and the third a rear drive also selling for \$3,000.

The Woods cars carry a battery which is specially made under the concern's own original design, and in increasing the battery power for 1916, the main change has been in the use of a greater number of plates per cell. Either chassis carries forty-two cells, and as a result of the plate change the mileage per charge is higher, the company giving the average as between 70 and 80 miles.

Much the same design is followed in both chassis, the frame being a special Woods feature in that it is narrowed at the front to allow a short turning radius. Like the battery, the motor is a special Woods design that is suspended in a subframe by means of a support on either side that has a ball and socket construction to allow free movement with the drive shaft. Located well back, the motor connects to the worm-driven rear axle with a short shaft that is inclosed within a torsion tube. Axle alignment is maintained by radius rods on either side. A special feature of the construction is the mounting of the rear springs upon the radius rods instead of on the rear axle. The radius rods extend from the subframe opposite the motor supports back to both ends of the rear axle at points just inside the brake drums and close to the center of wheel treads, and thus they act as a lever in relieving the rear springs of about one-third of the force of road vibrations, according to the designer. In the type of worm drive used, the worm is mounted under the wheel.

Hupp-Yeates Adopts Worm Drive

The only change in the chassis of the new Hupp-Yeates models as compared with those they supersede is the replacement of a bevel-drive axle for a worm drive. The Hupp-Yeates Electric Car Co., is now making three models, these being No. 3 Regent A which is reduced from \$1,750 to \$1,500, and the new models No. 4 Regent B at \$1,750 and No. 5 Patrician which sells at \$2,000. The first two are carried by the 86-inch wheelbase chassis and the last has a 100-inch wheelbase. But though the new cars round out the line, they follow the same general mechanical construction as the continued model with the exception that all three have the new worm axle that is furnished by the Cleveland Worm & Gear Co. It has a ratio of 8.6 to 1.

Model No. 5 is a four-passenger coupé with a thirty-six cell, eleven-plate Exide battery that supplies a 60-volt high-speed Westinghouse motor directly connected to the axle, the worm of which is under the wheel. Model No. 3 carries

thirty-seven cells in its battery and also uses a Westinghouse motor, though it is smaller—48-volt. Thirty cells are employed by model No. 4, which has the same size of motor as the No. 5. On all models Goodrich Silvertown Cord tires are fitted, these being 33 by 4 in all cases except the front of Model No. 3 which is equipped with the 32 by 3½ size.

The interior of No. 3 is the same as the old model it replaces, it being upholstered in cloth instead of leather, however. No. 4 is finished in Bedford cord cloth with folding front seats and a split front window, and the arrangement and fittings of No. 5 are very much the same. This latter

car is built with a very low appearance, due principally to the underslinging of the springs from the axles. It has a mileage capacity of 90 to 100 on a charge, it is claimed.

A feature of the Hupp-Yeates proposition is the furnishing as a part of the standard equipment of an electric battery charger, this being a Lincoln motor-generator type. Thus there is very little added expense attendant upon the charging of the car at the home garage, since it should not cost a great deal to have the charger installed. Hence any uncertainty as to the subsequent investment for car maintenance and charging is eliminated.

Hudson Crankshaft Eliminates Friction

Bending Couple Removed by Scientific Balancing—A New Idea in Balanced Engines

AUTOMOBILE engineers have been more or less curious to know how the Hudson company has been able, in its new six-cylinder motor, to obtain fully 80 per cent more horsepower than was delivered by the previous Hudson engine, which had exactly the same cylinder dimensions of 3½ by 5 in. Considerable mystery has shrouded the new design, and this curiosity was fostered by the fact that a patent on a principle involved in the engine was granted the Hudson company on Dec. 28, although the details upon which it was based were not divulged at the time the car was announced at the New York Automobile Show.

Aside from a careful and refined design along purely conventional lines, the patented feature and the secret lies in the counterbalanced crankshaft, the method of balancing being the really new thing. Careful attention to the working out of all details of valve passages, valve openings and carburetion, besides such other engineering considerations as design of the cams, timing and so on, have played their part in the increase of power which the Super-Six shows over its predecessor, and thus the ability of the new engine cannot rightfully be charged entirely to this new method of crankshaft balancing, although this is the one big factor.

Vibration Spells Power Loss

The reasoning on which the Hudson engineers have worked is that a great percentage of the power developed by a motor is absorbed internally in overcoming the forces which manifest themselves, these resulting in vibration and crankshaft distortion causing friction and loss of power. They realized that if they could reduce these wasteful forces to the minimum, the delivered power would be greater. This is really the germ of the present engine.

The new crankshaft is really not counterbalanced in the sense in which it is generally understood by the layman. The thing that has been done is to balance in a new way the forces present within the engine, this principle being what was patented. In order to understand the principle back of the design, it is necessary to follow through the reason-

ing which the designers used in determining the forces that had to be balanced at each point of the shaft.

First of all it should be said that the Hudson crankshaft is not balanced by having weights of equal size, shape and mass at each point of balancing, as would at first be expected. Reference to Fig. 1 will indicate the form of the weights used. There are in all three different forms of weights for different positions, and these are not forged integrally with the shaft, but are held in place by nickel steel bolts. The crankshaft is a four-bearing type, and at either side of each main and crank bearing there is a weight of some form. These weights are of a size and shape calculated to balance the inertia forces at the particular point at which each is located, and at any rotative speed of the shaft.

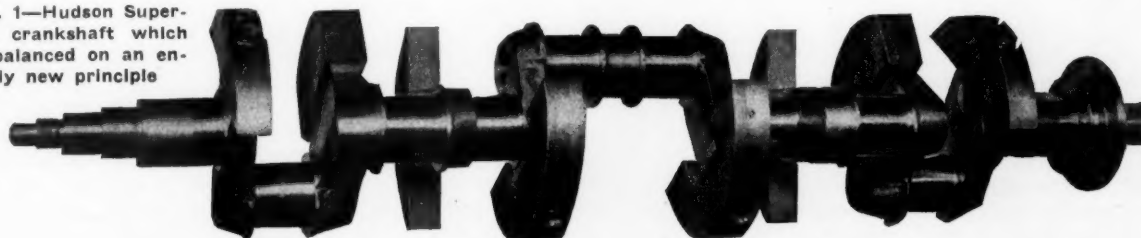
Weights Differ in Size

In proportion to the inertia forces present in a revolving shaft such as this, the unbalanced forces of the reciprocating parts are very small, hence these latter have been disregarded in the balancing of the more important and much greater forces due to inertia. Since these are of different magnitudes at each position along the shaft, the reason for the three different kinds of counterweights is apparent.

Referring to the diagrams in Fig. 2, the method of reasoning may be understood if we consider one one-half the length of the shaft, since the same conditions arise in the other half. In fact, the weights exactly correspond in their relative positions at either side of the center of the shaft. That is, the inertia forces with which we have to contend at a point three-quarters back from the front of the shaft are identical with those one-quarter back.

Suppose we consider then the forces acting on the first half of the shaft, which includes the first three throws. Each throw is in a plane at 120 deg. to the others, as indicated at A. The forces are considered all along the shaft from the first main bearing to the second, and in order to determine just what the inertia effect is at any point, it is necessary to determine the resultant inertia force that arises from the

Fig. 1—Hudson Super-Six crankshaft which is balanced on an entirely new principle



separate forces acting in each of the three planes. For instance, at Position 1, which is close to the front main bearing, the force acting in plane X is of a magnitude shown by the arrow in plane X, the amount of this force being calculated previously. Similarly, in plane Y, the magnitude of the inertia force acting in that direction is shown, and in plane Z it is shown in dotted lines. Now, referring to the vector diagram above at 1, these three forces are shown in their correct proportions and directions. From this, the resultant force F is determined by drawing the parallelograms of forces. At each position along the shaft the vector diagram is determined, and from it the resultant. In the chart the curve M is that of the forces acting at the different points in plane X, and N is the same for plane Y, as is O for plane Z. Referring to diagram B, we have plotted a curve of the resultant inertia forces acting at each point along the shaft between the two bearings, these being obtained in amount and direction from the individual vector diagrams already mentioned. This latter curve E indicates exactly the forces with which we have to contend at each position, and shows that the largest unbalanced force is at about the middle of the length between supports.

Hence, knowing the values of these resultant forces at each point, the Hudson engineers set about to balance these by weights of proper size at each position. Obviously, to bring the shaft into exact theoretical balance, there should be a balancing weight at each point along the shaft, but this being physically impossible, the practical compromise is to put the weights of correct size and form where they would logically go, this at the webs of the crank throws. The principle involved makes it possible to get a correct running balance, within practical limitations, at any speed of the shaft, since the counterbalancing weights have increased inertia forces set up as the speed increases just as the natural inertia forces increase with the speed, and the two sets increase or diminish alike, thus maintaining running balance all the time.

Shaft Floats in Bearings

From this it will be apparent that the only function of the shaft itself is to form a practical mounting for the weights and rods, for, with the inertia forces balanced in this way, the shaft theoretically floats in its bearings when running, and thus in theory even a rubber shaft would be horizontal at all points when running, were it strong enough to take the power load.

It is interesting to note that the new Hudson shaft is very little larger than the previous plain shaft was, which shows

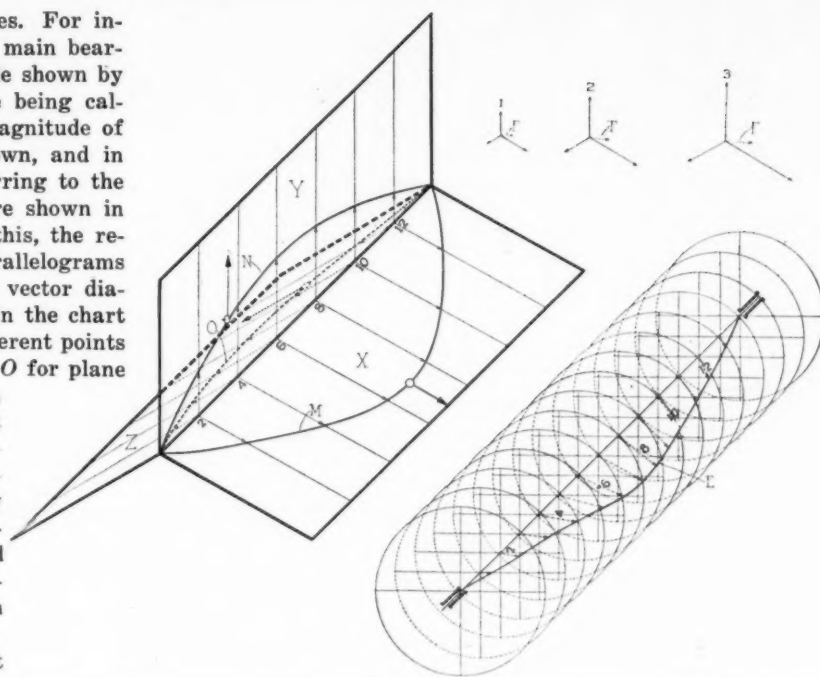


Fig. 2—Diagram of the forces acting on a six-cylinder crankshaft, for the purpose of explaining the action of the Hudson shaft which is balanced to eliminate inertia bearing pressures

that the matter of vibration has been attacked from the standpoint of inertia force balancing rather than stiffening to overcome vibration. Whether you stiffen a shaft or not, these inertia forces are still acting upon it and tend to increase friction and internal power absorption, so the logical thing to do is to compensate for them.

Of course, with these weighted throws, the crankshaft unit is heavier than that of the previous engine, although the better balancing makes possible a lighter flywheel. The new weighted shaft with flywheel weighs 164½ lb. whereas the old shaft weighs 120¼ lb.

In Fig. 3 is shown the power curve of the Super-Six engine, showing a maximum horsepower of 77 at about 2500 r.p.m., although the motor actually operates at close to 3000 r.p.m. as a maximum speed. When it is realized that at these high speeds the inertia forces amount up to several tons, the importance of this balancing becomes more apparent. Undoubtedly the Hudson engineers have attacked the problem of the eliminating of power-wasting factors at their source, and the results attained with the engine would seem to thoroughly justify the line of reasoning.

Automobile and Accessory Plants Help French Loan

PARIS, Dec. 23—Automobile factories have given considerable help in the raising of the \$3,400,000,000 comprising the national loan just closed. Before the loan was announced, all the automobile factories made systematic collections of gold from their staffs, it being very difficult for men working eleven or twelve-hour shifts for six and one-half days a week to make a personal visit to the bank, in order to exchange gold for paper money. When the loan was announced the factories undertook to receive subscriptions toward it, and in very many cases to advance money to their workmen toward the purchase of stock. There was no limit to the amount men could sub-

scribe for, and facilities were given for repayment by weekly instalments. Allowance was made for inability to make payments owing to illness, and if a workman left his employment before his stock had been redeemed, he was given the option of completing his payments or having all the deposits he had made refunded to him.

This scheme has proved very popular among automobile mechanics, most of whom are now earning good money and have been glad of the opportunity to invest profitably and safely.

The French staff of the Michelin Tire Co. has invested in this way a total of \$1,010,060. As early as September, 1914,

Michelin offered to loan money free of interest to any of his staff wishing to subscribe to the short-term treasury notes. In June, 1915, further loans were made to the staff toward the purchase of national defense bonds, and finally the total of more than \$1,000,000 has been subscribed by the staffs in France toward the recently closed war loan. This year the shareholders in the Michelin company were paid in the national war loan stock, an innovation which was accepted with general approval. All Michelin employees totally disabled in the war are given an annual life pension of \$190, this of course being in addition to the pension given by the State.

Italian Trade Profits By War

Factories Produce More Cars and Trucks Than Army Requires—
Passenger Car Development Continuing

By W. F. Bradley

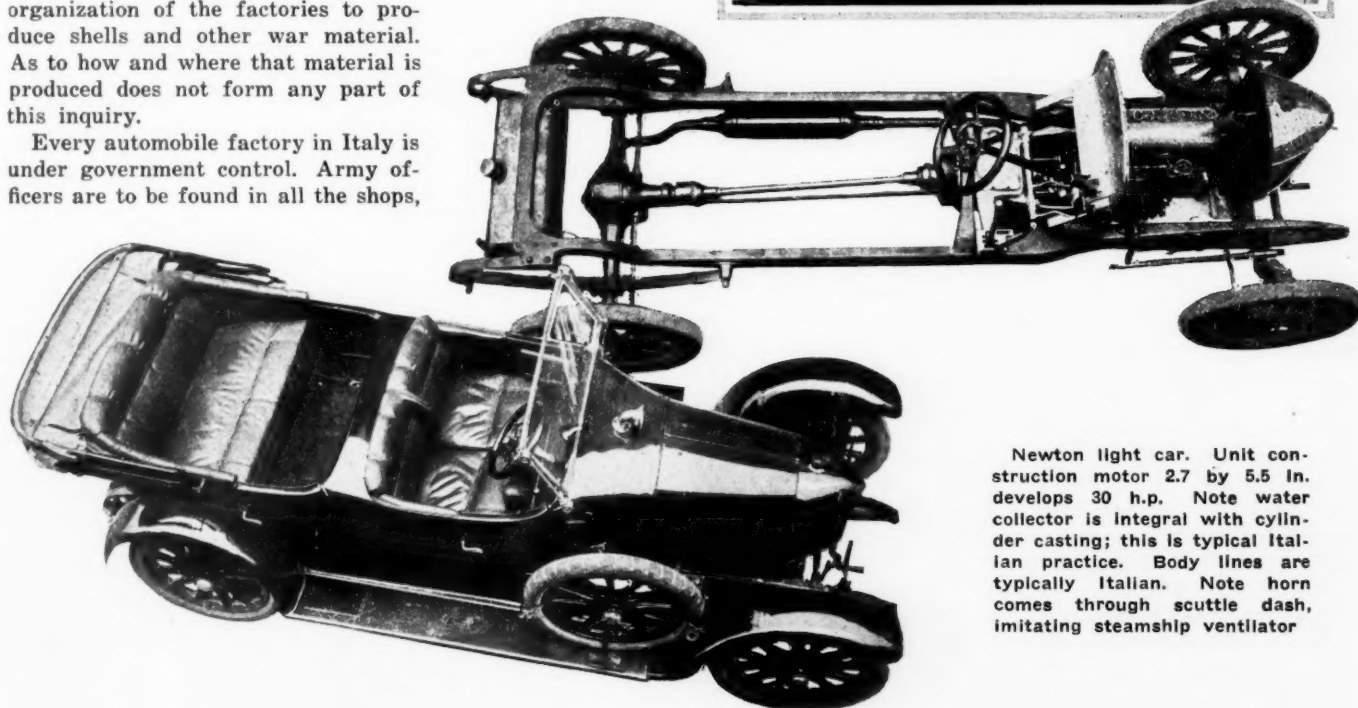
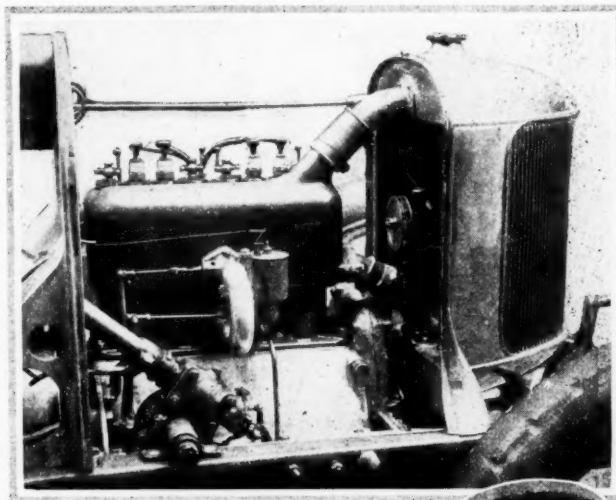
Paris correspondent of THE AUTOMOBILE, recently returned from examining the busy and prosperous automobile and motor truck industry in Italy. The following is the second of a series of articles on the subject and reviews the passenger car field

COMPARED with other European countries it has been possible to visit, Italy bears few external indications of a state of war. When the rigorous frontier formalities have been attended to, the visitor finds himself among a people, who have suffered neither the depression of an invasion nor the exhaustion of a long and undecided campaign. Alone among continental countries, Italy has imposed no restrictions on motoring, and with the exception of the frontier strip, puts no obstacle in the way of free movement of natives and visitors. Conscripts march to barracks behind a brass band; young recruits celebrate their last night as civilians with music and dancing; there is enthusiasm in the air, confidence among the people and not sufficient pinch to make even the poor dissatisfied. Here war is not Hell.

Coming into the war nine months after her neighbors, the Italian automobile industry has been affected quite differently from that of England and France. The lengthy preliminary warning made it possible for the industry to prepare for the war boom and to avoid many of the inconveniences of disturbed markets in a way that was not possible with the neighbors suddenly plunged into an unexpected conflict. The Italian factories have the Italian government as their chief client, and are producing for that client trucks, touring cars, tractors and aeroplane motors. The only change that has taken place is the transference of trucks to the primary position and touring cars to a secondary place. There has been no necessity to transform the internal organization of the factories to produce shells and other war material. As to how and where that material is produced does not form any part of this inquiry.

Every automobile factory in Italy is under government control. Army officers are to be found in all the shops,

and a badge on the arm of many of the workmen and foremen indicates that they are under military restrictions. Such men, whether they be day laborers or skilled engineers, cannot leave their employment, cannot strike, cannot run short time, or absent themselves without leave. The organization throughout is remarkably efficient, and although the Italian automobile industry is not as important as that of some other European countries, the quality of the factories is cer-

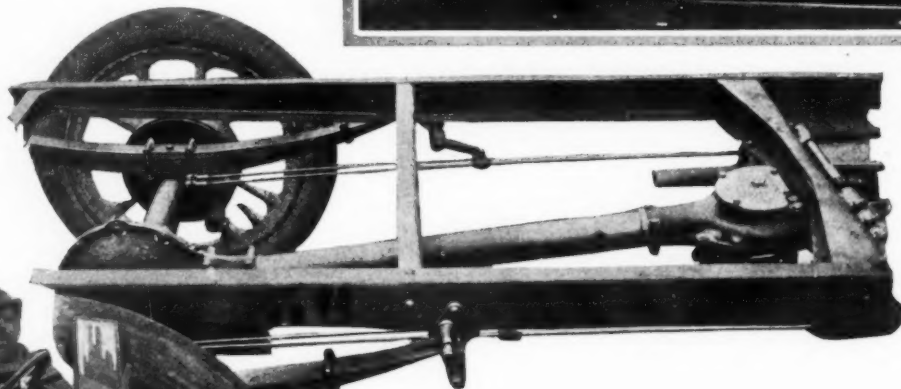
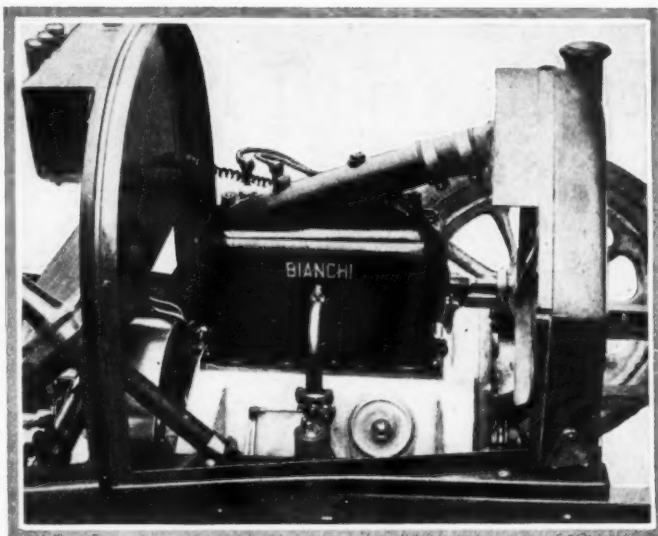


Newton light car. Unit construction motor 2.7 by 5.5 in. develops 30 h.p. Note water collector is integral with cylinder casting; this is typical Italian practice. Body lines are typically Italian. Note horn comes through scuttle dash, imitating steamship ventilator

tainly the best. Extensions are the order everywhere. There are very few factories in which building operations are not being carried out; this work is being done in a very systematic manner, and as the extensions are made with a view to increased output of the ordinary product, there is no confusion and no disorganization.

Labor Is Plentiful

There appears to be no scarcity of labor here. Women have not replaced men in any of the factories, and there has been no confusion by reason of the enlistment or the calling up of men necessary for the most efficient working of the shops. In all countries possessing compulsory military service precautions have to be taken against the shirker, who would prefer to do military duty in a factory, or some other safe post, rather than in the trenches. The Italians have got over this difficulty by making it a crime, punishable by a long term of imprisonment, without the option of a fine, for any employer to retain in the factories any man, who was not actually employed on that class of work before the war. It is not suggested that any Italian automobile manufacturer has ever been in danger of prison, or that this law was necessary to prevent abuse. But it is



Top—Bianchi light car four-cylinder motor 2.3 by 4.3 in. developing 18 h.p. at 2000 r.p.m. Center—Bianchi light car and car construction showing gearbox front end of torque tube and internal side by side brakes on rear wheels. Left—Italian mountain troops aboard a Bianchi light car

very convenient for the manufacturer to be able to point to the law when some wealthy and untechnical friend asks to be given factory employment in order to escape active military obligations. There appear to be sufficient men to supply not only army requirements but to make possible the production of cars for export. Obviously the value of exports has decreased, but it is not by any means a negligible quantity, some factories making quite important shipments overseas.

The greatest difference between Italy and her Allies is that she is able to produce within her own territory all the automobiles and trucks required for civil and military purposes. After very close inquiry I have been unable to discover a single foreign automobile in Italian army service. Trace was found of a sample White and a Denby truck at Rome, but it does not appear that any orders have been obtained for these. After England, France and Belgium, where American trucks are now as well known as the native article, it is a decided contrast to come into a country where all automobiles are made on the spot. Even Ford has failed to make any impression in King Emmanuel's territory. Italian automobile buyers belong to the wealthier classes of society and cannot be interested in the cheaper grades of cars. Thus the low-priced American cars failed to get any important hold before the war and have not been adopted since.

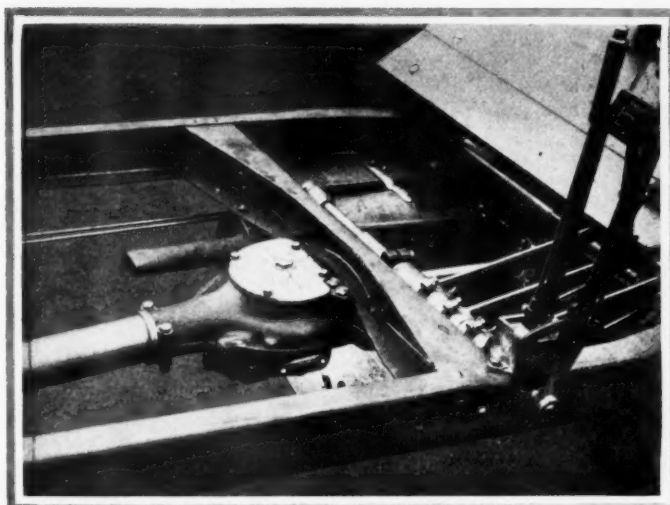
The first effect of the war was to make the Italian fac-

tories realize their dependence on Germany and Belgium for magnetos, forgings and stampings and certain steels. But the stoppage of supplies only came gradually and for several months after Germany was at war with France, England and Russia, she was sending supplies into Italy. Facilities were even given Belgian firms to send their stampings into Italy between August, 1914, and May, 1915.

Obviously Germany expected a return in the form of finished trucks, and it is possible that some went over the border. Indications appear to be, however, that the raw material came in readily and the finished material went out slowly or not at all. When war is threatening, it is an easy matter for government officials to delay cars on the frontier stations. Although there is a shortage of certain materials, the Italian factories began the war with immense stocks and still appear to be unusually well supplied with material.

Seventy-five per cent U. S. Magnetos

The magneto problem has been the most serious, for Germany had a monopoly of this branch of the automobile industry. Supplies are now being obtained from America, about 75 per cent of the automobiles produced in Italy being equipped with magnetos made in U. S. A. The remaining 25 per cent are German magnetos which are still being drawn from stock.



Gearbox on front end of torque tube, Bianchi light car

One important Italian electrical firm has taken up the manufacture of magnetos, but does not appear to have reached an important output at present. English magnetos were first used when the shortage made itself felt, but they were found unsatisfactory and have been abandoned. American magnetos are better, but the average is not high as that of Germany. In one of the most important test shops batteries now have to be used to help start the motors. No Italian car is equipped with battery ignition in any form. A few French magnetos have come through, but the objection to them is that they cost nearly twice as much as those of American origin.

Italy Makes Own Castings

Italy is entirely independent of outside supplies for iron, steel, and aluminium castings. Her cylinder castings are undoubtedly the finest in the world, and are all made at home. Fiat, Lancia and Scat are three of the leading firms making their own castings. Italian cars carry a greater proportion of aluminium castings than any others, and all these castings are made in and around Turin. The problem has been to get a steady supply of forgings and tool steels, for in these Italy was largely dependent on Germany and Belgium. Supplies are now coming from England, America, Switzerland, and a small amount from France, while important forges have been established in Italy and increasing supplies are coming from them.

Considerable trade can be captured here, for the feeling is strong against renewing business relations with German firms after the war. In going through one of the leading factory store rooms I was shown article after article which formerly came from Germany, but is now supplied by the Allies or by America. One example, of little importance in itself, is nevertheless significant. The set of wrenches and tools supplied with a high-grade car was obtained from a German house and was supposed to be of German construction. Quite accidentally it was found that they were made by a well-known American firm. Immediately the order went direct to America. American firms should not overlook the fact that a German distributor will not be in a position to do business outside his own country when peace conditions have been re-established.

There is no shortage of ball bearings; some of

the best are made in Italy and supplies are available from Sweden. All raw material has increased in price from 10 to 50 per cent. Tool steels are rather difficult to procure, but on the whole the Italian automobile industry is exceedingly well placed for material, due partly to the fact that enormous stocks were put in before the war, and partly to the fact that Italy is in a great measure self-supporting.

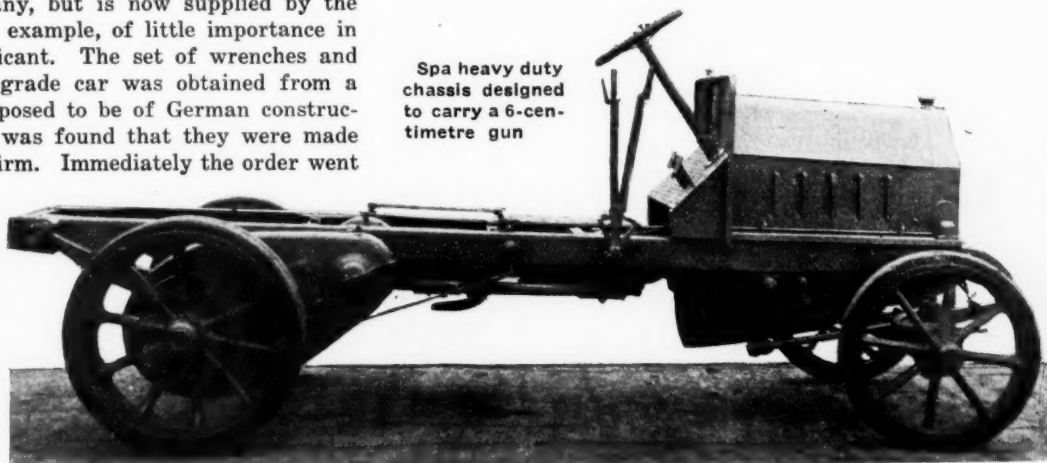
The greatest shortage is in coal and coke. Nearly the whole supply now comes from England, and although there is no danger of this supply failing so long as England retains control of the seas, the Italians would be well pleased if bigger supplies were allowed to come through. Coal has never been a very cheap commodity in Italy, but \$35 a ton may be considered a fancy price. Gas coke is sold at \$17 a ton. In the picturesque Italian idiom one automobile manufacturer said, "Let England supply the coal and Italy will furnish the blood."

Plenty of Tires Available

It is to be imagined that a German would be afflicted with apoplexy could he see the free use of pneumatic and solid tires in Italy and note the apparently unlimited supply. The leading native manufacturer is Pirelli, who produces pneumatics only, and is able to supply Italy and other allied countries. Michelin has an important factory in Turin, where pneumatics only are made. Since the war Goodrich has established an Italian branch near the Fiat factory, at Turin, and appears to be furnishing an immense number of solid tires to the Italian government. The American establishment is next door to what was recently the headquarters of the Continental Tire Co. The German name has been removed, but the trade mark still remains as a souvenir of a firm which, everybody declares, will *not* be re-established after the war.

A few English tire manufacturers are represented on the Italian market, but there never was much outside demand for pneumatics, and Goodrich doubtless does more business with solid tires than all foreign firms combined. Another American firm which attempted to fill Italian war orders had an unfortunate experience. An order for 5000 solid tires was obtained through a French house, and a first batch of 500 was delivered. These were the first band tires the firm had made and they proved so unsatisfactory that the president of the company had to make a special trip to Italy. It was agreed to replace the first batch free of cost, but the second shipment did not prove very much better.

The authorities appear to have realized that they were being experimented on and have considered cancelling the contract. This firm has never sold solid tires on the American market. Demountable solid tires are unknown in Italy; all trucks, without exception, have pressed on tires. Straight side pneumatic tires are **not** used.



Spa heavy duty chassis designed to carry a 6-centimetre gun

One of the effects of the war has been to stimulate the demand for automobile trucks among business firms. Up to a year ago the number of business trucks in Italy was not very great, but as the numbers of horses decreased and as the war furnished examples of the utility of trucks, a demand developed among business houses and the home factories have been able to meet it. Prior to the war Italy's specialty was touring car chassis, a comparatively small amount of truck business being done, and most of this was for abroad. The war has made it necessary for everybody to study trucks, with results that are not always quite satisfactory. There is too much adherence to touring car design and too much adaptation of touring car models to truck work.

Turin Is Italy's Detroit

Turin is the headquarters of the Italian automobile industry. Out of a total population of 430,000, about 25,000 or 30,000 persons are directly engaged in the automobile industry. The most important factory is Fiat, which with 10,000 workers on the pay-roll claims to be one of the largest, if not the largest automobile factory in Europe. Other Turin factories without attempting to put them in order of importance, are Lancia, Aquila-Italiana, Scat, Diatto, Itala, Rapid, Spa, Nazzaro, Chiribirri, and the Italian branch of the Gnome Co.

There is a local pride in the Fiat factory so great that every manufacturer, no matter how good his own establishment, will recommend the visitor not to fail to visit the Fiat works.

It is doubtful if any town in Europe possesses five more modern, better equipped, or better managed factories than those of the Fiat, Lancia, Nazzaro, Spa, and the Scat companies. In every case the buildings are well planned, laid out on a big scale, fitted with the most modern equipment, spotlessly clean, and really well managed. With the exception of Fiat the general layout is a big one-story main building divided in the center by the stores. At one side of the stores is the machine section and at the other the assembly department. Thus raw material goes in at one end, is machined, passed into the stores, and passed out at the opposite end to the assemblers. Around the main building are drawing and business offices, test shops, sand blasting, case hardening, nickeling, etc. Land is comparatively cheap, and some of the factories have their own test tracks banked for speed.

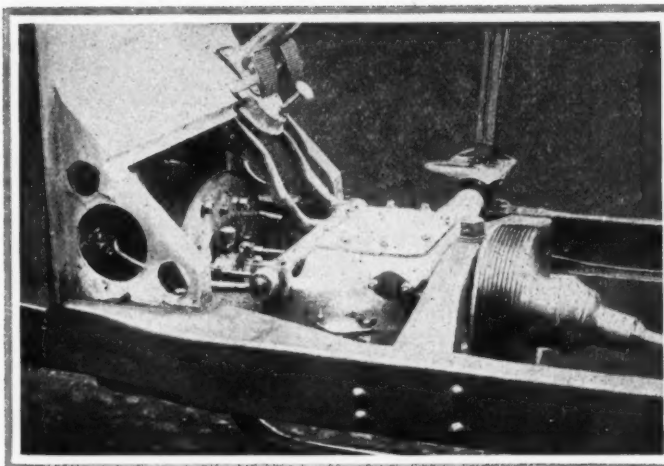
Fiat Plant American Type

The Fiat establishment is too big to be laid out on these lines, and the American system of five- or six-story buildings, with electric elevators, is adopted. During the present year the factory has produced 1000 cars per month, the majority of these being trucks varying from 1 to 4 tons. The capital of the company has recently been increased from \$3,400,000 to \$5,000,000, and stock which was quoted around 90 before the war is now negotiated at 170. Recent extensions will give the Fiat factory an output of 12,000 cars per annum under normal working conditions. It is doubtful if any other factory in Europe produces so many units of a car as the Fiat establishment. All iron and aluminum castings are made by the firm; they also make their own carbureters, radiators, springs, tanks, sheet metal parts, and all standard bodies.

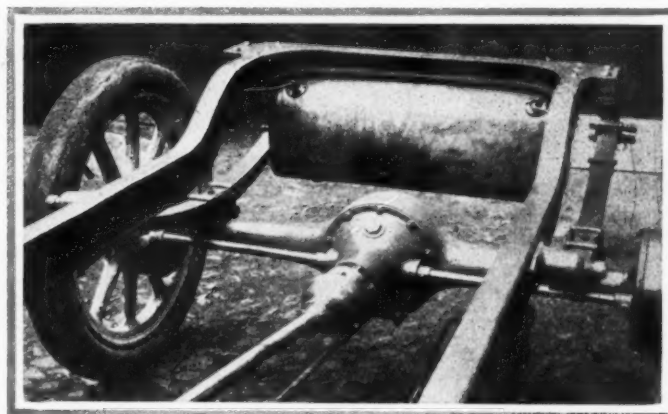
Of late years the factory has designed and built a very large number of its own machine tools.

Although labor is cheap, the average price paid to workmen at the present time being 20 cents an hour (this is rather higher than under peace conditions) modern labor saving appliances are extensively used. There is too much diversity of output to justify all the labor saving machinery found in American factories producing one model only, but the average compares favorably with the best equipped American shops.

One of the finest of the many departments is the motor test room. The motor beds are in two rows on each side of the building and have the exhaust, and inlet and outlet water



Gearbox forming unit construction internal foot brake and aluminum dash of Newton light car



Full floating axle of Newton light car. Note neat brake control

pipes cast in them; the gasoline lead is also permanently attached to the bed. Electric dynamometers run on rails in front of each row of motor stands. When the motor is put on its stand it is not moved until all tests are completed. It is first run light, then the dynamometer is brought in front of it, connected up, and the motor tested under load. The shop is remarkably neat and tidy and permits of the best work in the shortest possible time. Adjoining are test shops for gearboxes and axles, an examination department in which all motors are taken down and examined after undergoing the bench test, and a sound-proof room for motors.

The racing and experimental departments and test shops are in the same neighborhood, but these are entirely independent of the ordinary work and are in charge of special staffs. Throughout the war these departments have been working as in normal times, new models being developed, and during my visit I was shown a 300-hp. racing motor on the test bench with which it is intended to better the Fiat straightaway record put up by Arthur Duray at Ostend, Belgium.

In this connection it is worth mentioning that Duray's 300-hp. Fiat is in the finished car department at Turin by the side of the King of Serbia's recently repaired limousine. This racing machine, which is the biggest ever put on the road, with a height of about 5 ft. 8 in., is owned by a Russian prince. After Duray had set up the world's record, the French authorities refused to grant a license for this huge machine to be run on French roads. As Russia does not possess any highways suitable for speeds of 140 miles an hour, the car is in cold storage.

(To be continued)

The Romance of Accessories

Accessories Have Done Much to Make Motoring What It Is To-day and from Adjuncts Many of Them Have Developed Into Necessities

THE automobile of 1916 would be a very different sort of a machine had it not been for the activities of the accessory manufacturer during the past fifteen years. Taking just the high spots, imagine a car without a speedometer, without starting and lighting, without curtains to the top; even one may add, without good spark plugs and without an automatic carbureter.

All these things and many others, too, were developed as accessories, as things upon which the owner of a motor car might be persuaded to spend his money. The history of the accessory industry repeats itself rapidly. Some bright inventor sees an opportunity to make an automobile a more convenient machine to own or to use, something which makes for efficiency, for comfort or for luxury. To develop it capital is found, after experiment has proved its value, and it then appears in a form or forms which are readily adaptable to existing cars. Ingenuity is turned to devising means for applying it to cars never designed to take it, and in the Ford starter business we see the highest possible phase of this.

Stock Equipment Is Goal

Then the next stage may be quick or slow in coming, it depends upon how popular the accessory becomes. If it reaches a degree of favor which causes it to be seen on a large proportion of cars the automobile manufacturer becomes interested and adoption by one may lead to general use, as has happened with the speedometer, as has happened with the starter, and as is happening with the engine driven tire pump.

When the manufacturer takes up an accessory and begins to order in his tens of thousands that accessory becomes a component just as a motor or an axle so becomes. A true accessory is something which is not part of the original makeup, something which the user can buy and add as it pleases him so to do. Perhaps the day will come when there are no more accessories, when every automobile is complete to a point where nothing more can be added, but it is unlikely that any who read these words will live to see that day. Meanwhile there is scarcely a car that cannot be made more comfortable, more efficient, or more luxurious by the expenditure of a few dollars now and then. Also it must be remembered that there are things which wear out. It is necessary to replace spark plugs at regular intervals, warning signals of the various sorts grow old faster than

the car that carries them and new things may come along worthy of attachment, just as a motor operated tire pump is well worth adding to a sound chassis not so provided by its maker.

Non-Stock New Parts

Then, too, there are the repair shop accessory opportunities. When an old car with many years' service ahead of it is being limbered up there offers a chance to put in new piston rings of a better pattern, to substitute aluminum pistons, perhaps to change the carbureter for a more efficient and economical instrument. This is a condition which will be with us always, at least as long as the automobile goes on improving from year to year, as it seems likely to do for a very long time indeed.

Of course there are a few accessories offered for sale that have little worth, that are just novelties with no useful purpose, but they are a very small minority indeed. Practically everything to be found in a well stocked store of automobile accessories is worth the price asked for it and many motorists lose a great deal by not paying sufficient attention to their dealer's display. By a proper and judicious purchase of new fittings and new attachments an old car can be kept in efficient and convenient condition for several years longer than if run in its original state all the time. No man hesitates to refit his home with metallic filament electric lamps in place of the more extravagant carbon ones; to buy a new rug or a new chair from time to time. Why, therefore, should he neglect to maintain the usefulness and even the appearance of his car?

Progress In Detail Noted

Whether stock parts or true accessories the great change in the past year is in sturdiness of design. Simpler and stronger parts, better adapted to the rough and tumble usage of automobile service, have become the rule. It is particularly noticeable that quality is taking its proper place as a selling argument, and it seems that the buyer is coming to understand that a good article at a fair price is better value than a poor accessory at any price.

Amongst the major accessories, the things which manufacturers have taken up and are now taking up THE AUTOMOBILE reviewed those of the greatest importance during the fall. There remain several others in the making of which progress is to be recorded and these are dealt with in a general way in the pages which follow.

Better Trip Reset on 1916 Speedometers

Flush Mountings for Instrument Boards also a Feature
—No Changes in Principle

Magnetic, Centrifugal, Air and Liquid Are Four Systems Used

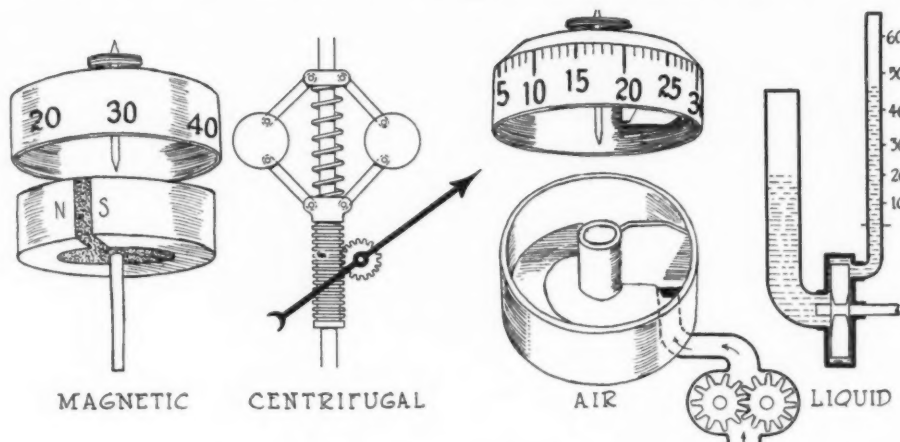
WHILE at first glance it would hardly seem that road route books and speedometers could be in any way interconnected as regards the design of the speed and distance recording instrument, yet the refinements of the year show this to be so. When touring by route book it is essential that the readings of the odometer correspond with the book mileage. Consequently the odometer part of the speedometer, to reach its maximum usefulness must be so arranged that the trip mileage reading can be set to whatever distance is required. The 1916 speedometer is equipped with a wheel or other efficient reset mechanism which permits of this, and the universal adoption of the trip resetting mechanism is the distinctive speedometer improvement of the past year.

The wide adoption of the instrument board has given rise to the second improvement, flush mounting. With this style of mounting only the face of the instrument projects through the instrument board, thus giving a neat appearance which coincides exactly with the harmonizing lines of the interior of the cowl. On some of the high-priced cars an additional speedometer is mounted flush with the back of the driver's seat. The driver's instrument is then carried on a frame at the toe board in the custom-made bodies and the instrument board is abandoned.

Two Main Refinements

These two refinements, the accessible trip reset and the flush mounting, are the two features of speedometer improvement. In fundamental principle none of the makes has been altered and the broad classification of magnetic, centrifugal, air and hydraulic operation includes the four basic methods by which the car speed is transformed into mileage readings on the dial.

The magnetic principle as indicated in Stewart-Warner and American Ever-Ready instruments, utilizes a revolving magnet positively driven from the car wheel or other part. The magnet exerts its influence on a metal part which is sep-



The four principles of speedometer operation: Magnetic, in which a revolving magnet exerts its drag on the dial; centrifugal, in which revolving weights supply the energy due to centrifugal force; air, in which a current of air flows against a vane carrying the dial, and liquid, in which a column of liquid is lifted a height proportional to the speed of pump drive

arated from it by an air gap and which in turn is connected with the indicating mechanism. The metal part is generally aluminum as the inertia of the part must be kept as low as possible to make the speedometer quickly sensible to speed changes. A feature of the magnetic design is that the travel of the dial bears a direct ratio to the speed of travel of the magnet, and in order to compensate for changes in the drag due to temperature differences, a compensating unit is fitted.

Centrifugal control as utilized in speedometers is very much the same as that on a fly-ball engine governor. Standard, Johns-Manville, Sears-Cross, Corbin-Brown, Hoffeker and Garford use this principle. Weights are mounted on the revolving shaft by bell crank levers which allow them to travel further from the axis of the shaft as the speed of the drive increases. The centrifugal force of the weights increases as the square of the velocity of the shaft.

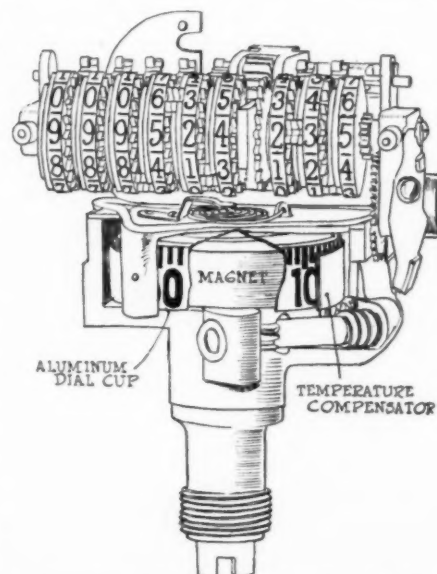
Weights Actuate Needle

This tendency of the weights to fly from the axial center of the shaft under the influence of centrifugal force furnishes the basis of the indicating needle movement. An ingenious feature in centrifugal design is that although the movement of the weights would naturally vary as the square of the speed, the levers or cams governing the movement are so calculated that calibrations on the dial are uniform or nearly so. Another feature which is carefully watched is the balance of the weights. The governors are made very sensitive so that even at low speeds the correct rate of travel may be indicated. Improvements in this direction have been made within

a year by at least one of the centrifugal speedometer manufacturers.

The air principle is used only on one make, the Van Sicklen, in which a blast of air from a pump within the speedometer forms the source of operation of the indicator needle. As the speed of the drive increases the volume of air flow becomes greater, thereby increasing the travel of a pivoted dial, calibration of which is effected by governing the size of the passages through which the air flows.

One instrument, the Veeder, which employs the hydraulic system, uses a centrifugal pump which is connected



Stewart magnetic speedometer. Magnet revolves exerting pull on aluminum cup carrying the dial. The faster the magnet revolves the greater will be the pull on the cup against the action of the hair spring above the cup. Temperature compensation is taken care of by a thermostat which surrounds the dial

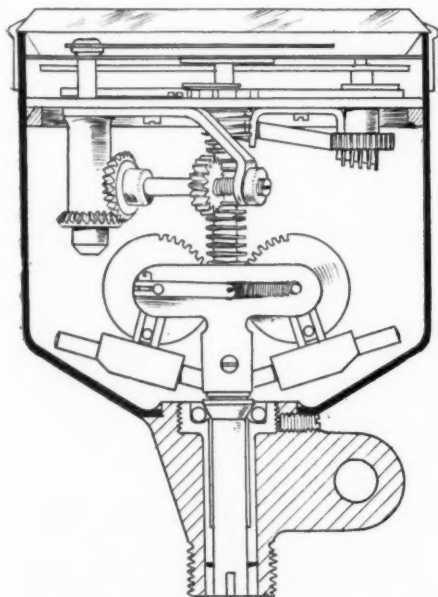
with the drive and which lifts a liquid to a height proportional with the speed of the drive. The tube in which the colored liquid is lifted is calibrated to register speed.

Stewart-Warner

Stewart-Warner magnetic instruments are made with flush mounting and with a convenient form of wheel reset. The instrument has but one moving part, a circular magnet over which fits an inverted aluminum cup. This cup does not touch the magnet, being separated from it by an air gap through which the lines of magnetic force travel. On the outer rim of the cup is the dial.

The magnet is positively driven as the car travels, at a rate proportional to the speed of the car and the faster the magnet revolves the greater the pull exerted on the cup and dial. A hair spring controls the movement of the cup and the greater the pull exerted by the revolving magnet the further the cup is pulled against the action of the spring.

The indication of very low speeds is one of the features of the Stewart instrument. The tungsten steel magnet being in the form of a circular ring acts as its own keeper, thus rendering it permanent. Delicacy of action is secured by having the pivot point mounted on a jeweled bearing and the upper support of the cup is also a jewel bearing. The temperature compensator is a thermostat which is nearly a complete circle surrounding the dial but leaving the



Standard centrifugal speedometer. The feature of this instrument is the ingenious arrangement of the spring tension applied to the levers mounted on the governor weights. By this system of levers it is possible to have the divisions on the dial of the instrument equally spaced, although the centrifugal force varies with the square of the speed. The movement of the rack is proportional to the speed of the car

part which comes before the reading window uninterrupted. This compensator maintains the correct adjustment of the hair spring under varying temperature conditions.

The passenger car types cover a wide range and can be secured in various combinations with clocks and electric lamps. Probably the most important announcement made by the Stewart-Warner Corporation regarding its speedometer line is the Ford type at \$10, which is the lowest price of any instrument.

Standard Thermometer

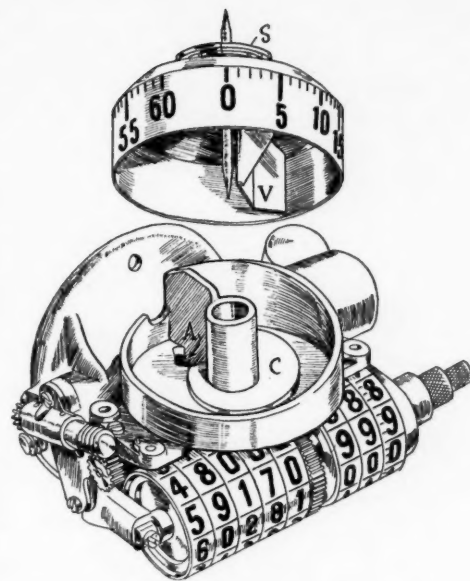
Illustrating the tendency toward accessible and quick trip resetting mechanism the Standard Thermometer Co. has incorporated in its 1916 instrument a wheel reset which can be operated in 3 sec. This new resetting mechanism and a model adapted for rear drive are the principal improvements. Two distinct types of speedometers are at present being made by this concern, both operating on the centrifugal principle and known respectively as the Ford and Chevrolet 4-90 designs. There is no difference between these two in respect to the speed and distance measuring parts, the only variation being in the form of case and method of installation on the dash or control board.

The Chevrolet 4-90 type represents up-to-date practice in having the speedometer mounting flush with the control board. All portions of the case and supporting flange are finished in nickel plate with the trip reset button projecting from the upper right portion of the flange.

In carrying out the centrifugal principle two weights are carried upon a light arbor, driven through a flexible shaft from the front wheel. The rotation of the arbor causes the weights to fly from the axial center due to centrifugal force and as they move a sleeve is actuated, which slides along the shaft, a distance proportional to the speed of the car. The movement of the sleeve is transmitted to the indicating hand on the dial by means of a rack or series of rings turned on the surface of the sliding sleeves. These rings being in engagement with a toothed sector which, by means of a multiplying gear train, actuates the indicating hand.

Since the indicating hand of the speedometer is not actuated by the rotating arbor but by the centrifugal weights the speedometer hand will not vary in its indication unless the speed of the car varies. This is true because only an increase or decrease of speed will cause the weights to depart from or approach the axial center.

A feature of the speedometer is the uniform scale divisions throughout the entire range of speeds. Although the centrifugal force increases as the square



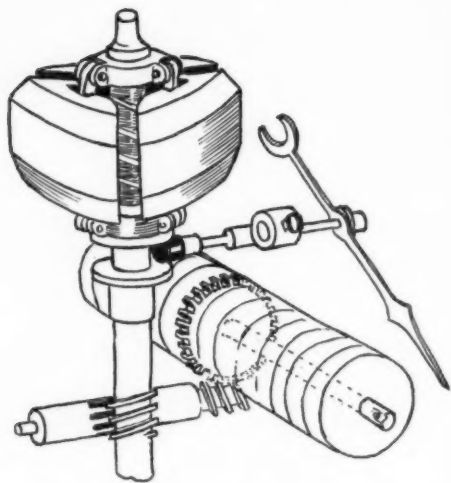
Van Sicklen air-system speedometer. Air current from gear pump enters through an opening on the other side of the wall from the outlet A and flows against the vane V in the inverted cup, which carries the dial. The cam C regulates the escape of the air and compensates for the greater flow at increased speeds. The dial cup is limited in its movement by the hair spring S

of the angular velocity, the compensating arrangement in the Standard speedometer due to the use of suitably formed levers mounted in conjunction with the weights and spring tension units permits of the uniform speed division.

A new development makes impossible an error in the trip reading of more than 0.05 mile. This gives a feature which is valuable in following mileage readings in route books, as it is often impossible to determine if the car is in the first or last half of a tenth mile. Another new feature is a new pressed steel adjustment bracket for Fords installed by removing the right spindle nut. The Ford type sells for \$12 and the Chevrolet design for \$15.

Van Sicklen

The Van Sicklen air speedometer utilizes the drive of the flexible shaft to create an air current by a small gear pump. This air current flows against a vane on a pivoted aluminum cup on the outside of which is the moving dial. A hair spring holds the cup normally at zero, and as the strength of the air current increases the vane tends to rotate the cup against the hair spring to the correct registering position. The direct means of governing the travel of the dial is by varying the volume of air increases, but the pressure is prevented from rising by the proper governing of the air openings. Thus, for any position of the dial there is a definite amount of air flow which does not vary until the speed varies, thus keeping the dial steady at definite speeds. Conforming



Johns-Manville centrifugal speedometer. The centrifugal weights are carried on bell crank levers and are controlled by a spring. The combination of spring and levers is such as to proportion the travel of the sleeve to the speed of the car. The sleeve action is transmitted to the needle through a small crank. The odometer action is by worm and gear

to modern practice a wheel reset is used so that any mileage desired may be set on the trip odometer.

Corbin-Brown

Improvements on Corbin-Brown centrifugal speedometers, that are now also made in the flush mounted type with wheel reset, include a new form of attaching bracket which allows the instrument to be adjusted to four positions on either the right or left side of the dash by merely removing two set screws. The swivel gear section in which the gears are made and hardened, is in one piece with the shaft, to which the cables are attached. Large collars hold the gears in correct position and considerable space remains for grease to be packed into the housing.

The centrifugal weights are balanced about the shaft and as they fly from the center they move a rack consisting of a number of rings turned on the vertical shaft. As the rack moves up or down, according to the speed variations, the hand is caused to travel along the dial through a gear train mechanism.

Prices vary from a Ford type at \$12 up to \$30 for a flush-mounted design with a 3-in. dial.

Johns-Manville

The Johns-Manville centrifugal speedometer is the development of what was formerly known as the Jones. The instrument has been redesigned so that now the entire mechanism is assembled as a unit on a framework, before being put in the shell or casing. This framework can be lifted out of the shell allowing an easy inspection. The instantaneous reset plunger has been replaced by a wheel reset which allows of putting

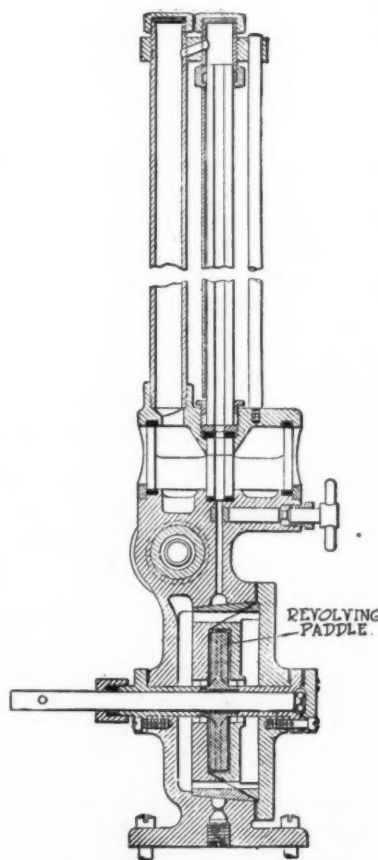
the trip mileage at any figure. Another improvement is in rendering the governor mechanism more sensitive so that it will accurately indicate very low speeds. Better balance of the weights, thus eliminating the vibration of the indicating hand, has been secured. The speed scale is redesigned, giving increased scope with larger figures and the indicator pointer does not pass in front of the odometer window to obscure the figures on mileage.

Johns-Manville, in working out the centrifugal system, uses three balanced brass weights connected with links and swinging freely on fixed pivots mounted on the driving spindle. When the spindle is rotated through the medium of gears and the flexible shaft the weights tend to separate, operating a cam movement which moves the indicating hand to the correct position on the speed scale.

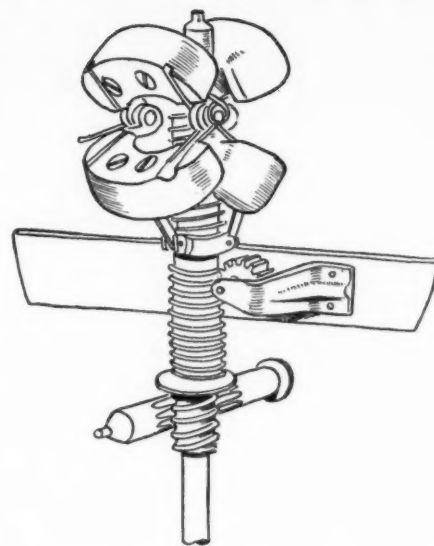
The season mileage reads up to 100,000 and the trip mileage to 100. The number of models manufactured is nine, four of which are $3\frac{1}{4}$ in. diameter, four of 4-in. diameter and a special model for Fords. The $3\frac{1}{4}$ -in. instruments range from \$25 to \$30 in price, and the 4-in. \$50 to \$60. The Ford type is \$12.

Hoffecker

The Hoffecker models include a new Ford type at \$12. This has a wheel



Veeder tachometer. The liquid or hydraulic principle is utilized in this. The centrifugal pump lifts a column of liquid to a height proportional to the speed



Elements of the Corbin-Brown speedometer showing how the centrifugal principle is worked out. The weights actuate a cylindrical sleeve carrying a rack which is made up of a series of rings turned on the sleeve. The odometer system is operated by the worm turned on the shaft below the rack

reset and the detail improvements show that the number of working parts have been reduced and rendered stronger than heretofore. The instrument has a 100,000-mile season mileage and registers a speed up to 50 m.p.h. Trip mileage is shown by a separate hand which travels around the same dial as the speeds are recorded upon but with a separate scale outside of the speed scale. The total trip mileage is 100.

Veeder

Veeder speed indicating instruments have not been changed for 1916. The hub odometer is the feature of the Veeder line. This instrument is mounted on the hub of the wheel and registers the distance traveled backward as well as forward. It is sealed on the hub of the wheel and cannot be removed except by breaking the seal. The tachometer is the instrument for registering both mileage and speed and, as previously explained, the speed is indicated by the height of a column of liquid which is governed by a centrifugal pump. With all fittings this sells for \$50.

American

The American Ever-Ready magnetic type is made in four models, one of which has been changed for 1916. All are of the needle-indicating dial design. The 60-mile instrument with season mileage only lists at \$15 and with trip mileage at \$20. In addition there are two 80-mile designs at \$25.

Sears-Cross

A new Ford model has been brought out by Sears-Cross under the trade name of Spedindicator.

(Continued on page 168)

Horns Better and Lower in Price

Electric Types Continue to Gain in Popularity with the Universal Use of Electric Starting and Lighting Systems—Simpler and More Accessible—Hand Horns Also Improve Greatly

REFLECTING the progress and tendencies in automobile design, the developments in the horn field during the past year have been toward lower prices, simplified construction, improved workmanship and better quality materials, together with greater accessibility of parts for lubrication and adjustment. There has been another tendency, too, peculiar to the horn field, which is toward rendering the instruments more flexible in tone, that is, enabling the operator to evoke either a loud, startling note of warning for emergencies or a softer, more courteous tone for occasions where there is no immediate danger but the car driver feels that pedestrians or other drivers should be apprised of his coming.

In motor-driven constructions, there is a tendency toward the use of horizontally-disposed motors actuating a button on the diaphragm by a toothed cam or wheel on the end of the motor shaft, the angle of impact differing in various makes.

An interesting development in hand-operated signals is the introduction of the underhood type in which the standard lever is used, but instead of having this directly attached to the horn, it is mounted in a casing which can be attached anywhere for easy operation while the impulse is transmitted to the horn under the hood through a flexible shaft.

Quantity production and the adoption of improved manufacturing methods are responsible for many refinements. Greater care has been expended upon design, there being more instances than ever before where the manufacturer has provided adequate bearings, automatic lubrication for the working parts and greater durability, which is to be expected from both the quality of the materials used and the arrangement of the components for least wear and maximum ease of operation.

Prices Are Much Lower

The manufacture of automobile horns in quantity, bringing with it the improvements mentioned, has also brought much lower prices, especially in the hand-operated and vibrator classes, though there are also a number of motor-driven signals at prices very much lower than any listed at the beginning of last year. In fact, it is now possible to buy a good motor-driven horn at a lower price than was charged for a hand-operated type a year ago. As for the prices of the hand horns, simple, strong constructions are now obtainable at about half the price demanded for similar instruments at the beginning of 1915.

Accessibility Is Greater

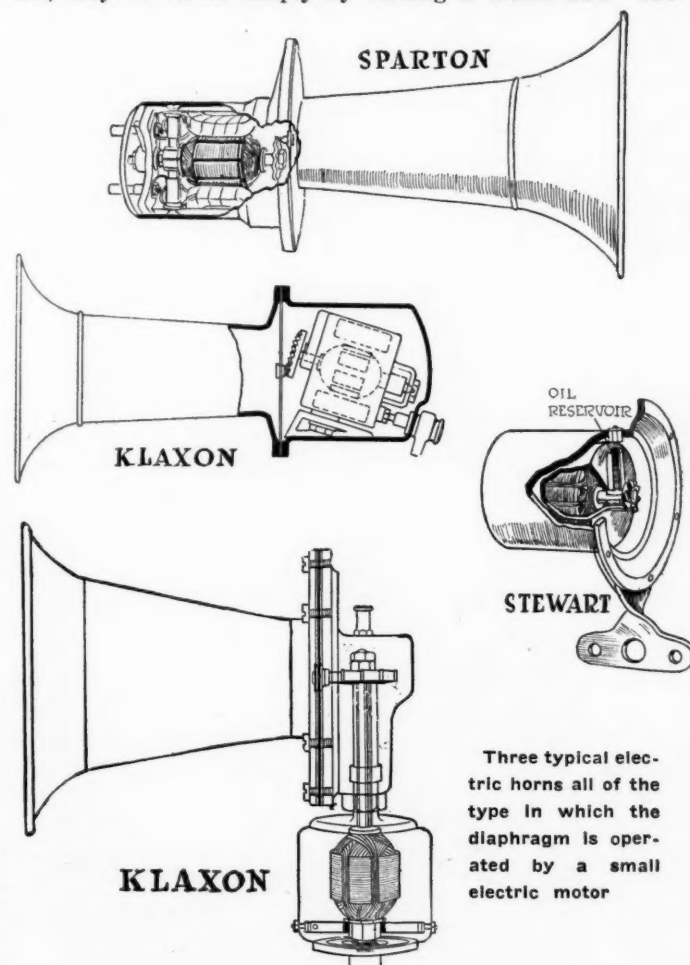
In the way of making things easy for the car owner, increased accessibility for adjustment, lubrication or possible repair show marked advances over the progress registered in these features at the opening of 1915. Automatic lubrication of the parts, where friction is a factor, may also be included in this category. It is these little bits of thoughtfulness on the part of the manufacturer which go to make automobilism more of a joy each year and automatically enlarge the field for his instruments by the reflex action of creating more automobilists. This year some horns have adjustments outside where they were formerly inside the casing and more

or less fussing was required before the pitch or tone could be altered in the slightest degree. It is much easier to get at the parts for inspection and oiling, it being no longer necessary to practically disassemble the entire horn to carry out these simple steps. In some of the constructions now employed it is but a moment's task to loosen a thumb nut or two and the entire mechanism is revealed. Many diaphragm types are adjusted for pitch by turning the screw button in the diaphragm.

Another feature is the use of an oil pad which keeps all the working parts of the horn constantly lubricated, while wells for retaining and distributing the oil applied to horns with the conventional lubricating arrangement are more widely used and better shaped than was formerly the case.

Electric Horns Are Improved

A notable improvement in motor-driven types is the simplified construction adopted by the Sparton, manufactured by the Sparks-Withington Co., Jackson, Mich., the housing having been made a much better manufacturing proposition by replacing the curved exterior with a straight type, while the adjustment has been brought outside so that the pitch, etc., may be varied simply by turning a thumb nut. The



commutator is much more accessible for inspection and oiling than formerly.

A number of new motor-driven horns have been placed on the market during the past year, a prominent example being the Stewart, made by the Stewart-Warner Speedometer Corp., Chicago, Ill. It is a horizontal type in which a toothed wheel on the end of the motor shaft impinges on the button on the diaphragm. Economy of current is one of the aims in its design as well as light weight and immunity from motor trouble. The large mushroom buttons used with this horn may be operated by a push from any angle with the horn or elbow.

The most recent additions to the line of the Lovell-McConnell Mfg. Co., Newark, N. J., are the U. H. Klaxon and U. H. Klaxet, the former having a straight-side projector and the latter a bell-type projector. Both use the horizontal motor construction in which the motor is set somewhat at an angle so that the toothed cam on the motor shaft strikes the diaphragm button. These two new models are much lower in price than any previous Klaxon instruments of this character. The rest of the line, including the large type L, using a vertical motor, is continued without change in design. A feature of the Klaxon horns for 1916 is that they are all to be finished in a new black enamel called Klaxon black, this step being a reflection of the tendency in car construction to use plain black finishes, doing away with finishes requiring care and polishing on the part of the car owner.

Another concern of importance continuing a standard line of horizontal motor-driven horns is the Automobile Supply Mfg. Co., Brooklyn, N. Y.—manufacturing the Newton in both outside and underhood styles, as well as a magneto-driven vibrator horn for Fords and the Apollo vibrator type.

In addition to four vibrator types, the Garford Mfg. Co., Elyria, Ohio, has produced the Rexo II, horizontal motor-driven type at a low price, its construction being a good illustration of the possibilities of simplified manufacturing processes, the electrical element being mounted on a one-piece stamping. A feature of this horn is the fact that there are no friction surfaces to lubricate or adjust. The only adjustment necessary is made once a season with a screw-driver to take up wear.

Another horizontal motor-driven horn recently put on the market is the Eaco, produced by the E. A. Laboratories, Inc., Brooklyn, N. Y., which is made in two types, the conventional and underhood styles. In addition to the regular size a smaller size is made for small cars and has no projector.

A horizontal motor design has been added by the Electric Spark Appliance Co., Brooklyn, N. Y., under the name of Olympic, being made in two styles for outside mounting and under the hood. The other types made by this company are vibrator designs in the same styles as the motor-driven.

Two motor-driven horns and two vibrators are made under the name of Samson, by the American Electric Co., Chicago, Ill., both types following standard principles of construction.

A new low-priced vibrator horn for the Ford flywheel current is the Heco, which is made by the Heinze Electric Co., Detroit, Mich.

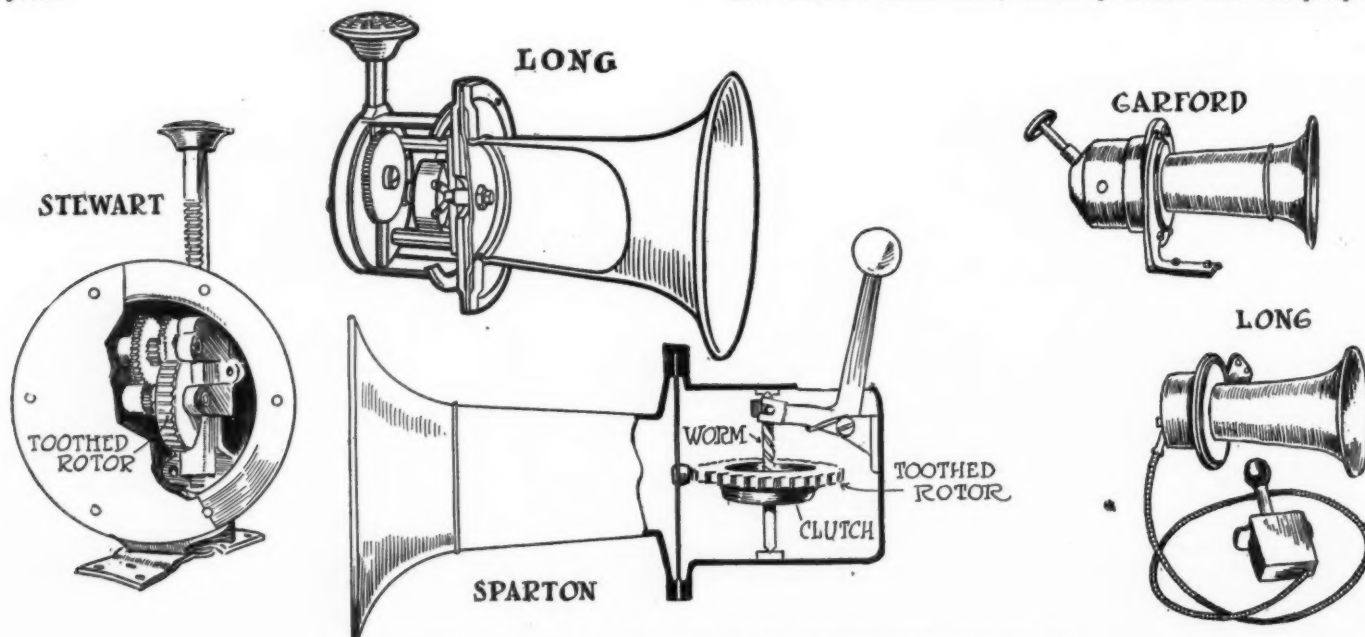
One of the makers who have aimed to produce a motor-driven signal that will not shock or disconcert pedestrians or drivers is the Holtzer-Cabot Electric Co., Brookline, Mass., and Chicago, Ill., which manufactures the Reacto hammer-blow type. This horn is adjusted by simply turning a screw to the left for a louder tone and to the right for a lower tone, it being arranged so that this screw cannot work loose. No tools are required to make the change.

Hand Horns Simpler and Less Expensive

Developments in hand horns have been chiefly in the way of lower prices made possible by increased production and simplified manufacturing processes and in stronger, better and simpler construction. Practically the same improvements which mark the Sparton motor-driven type have been embodied in the hand horns, made by this company, the housing having been treated in exactly the same way to render it a better-appearing and more practical manufacturing proposition, while the exterior adjustment for pitch is also furnished. The horn operates through a nut on a vertical worm shaft which carries the toothed rotor against the diaphragm button.

An important event in the hand horn field, late in 1915, was the taking over of the sales of the Long horn by the Edward A. Cassidy Co., New York City, from the H. W. Johns-Manville Co., the latter concern intending to market a hand horn under its own name early in the spring. An underhood hand type has been added to the Long line, this corresponding to the standard construction except that the operating lever may be located on the side of the driver's seat, on the dash or some other convenient place, whence it operates the horn by means of a cable. The Long construction uses a rack and train of gears to actuate a weighted wheel having rollers radially disposed around its surface to engage the diaphragm button.

The Stewart hand horn, which preceded that company's



A representative group of mechanically operated horns with hand control

motor-driven type embodies standard principles of construction, being of the rack-and-gear type. Besides its lower price for 1916, one of its distinctive features is the use of an oil-soaked felt pad which rubs against bearings and wheels continually, insuring constant lubrication, while another is the use of a double supporting bracket for the horn, which prevents it from getting loose and wobbling even under the most severe usage.

As an indication of the thoughtfulness of the horn manufacturer, the 45-deg. plunger used on the hand Garford is an interesting illustration, this construction permitting maximum ease of operation inasmuch as the operating movement is a compromise between a vertical stroke and a horizontal push. Other features of this horn are: Only four points to oil once a season and three-point suspension mounting bracket insuring rigid attachment. The rotor is on the center line of the horn and the cam wheel is on the shaft between two sets of bearings and acts direct on the diaphragm button.

Many New Hand Horns

Among the new hand horns on the market are: The two new Seiss instruments made by the Seiss Mfg. Co., Toledo, Ohio, which are of the type operated by turning a crank in either direction, the drive being by a bevel pinion and bevel wheel.

The Standard, made by the Standard Metal Mfg. Co., Newark, N. J., employs a vertical spiral shaft and a train of gears. The Eaco made by the E. A. Laboratories Co., Brooklyn, N. Y., in two sizes and employs a rack and pinion mechanism, the rack being on the plunger and the pinion cut in the shaft. Samson-Lion and Samson-Tiger are made by the American Electric Co., Chicago, Ill., the Samson-Lion having a vertical plunger action and the Samson-Tiger being of the rotary type, operated by a twist of the wrist or elbow. The Wondertone, made by the Motor Appurtenances Corp., New York City, has its rotor set at an angle to the diaphragm button instead of perpendicular to it. Thus, the ratchet handle is on the center line of the horn, making it suitable for cars with either right or left steer, the ratchet driving the rotor shaft direct. With this horn it is possible to give either long or short blasts; the A-K, made by the Angsten-Koch Co., Chicago, Ill., in two lengths of projectors. This is a plunger-operated type; the A. W. T., made by the American Watch Tool Co., Waltham, Mass., in which solidity of mounting is obtained by curving the horn body downward so that the supporting feet are short and strong. This allows the operating knob to be placed at a convenient angle for either the hand or foot. The striker may be easily adjusted by unscrewing the horn bell. Another feature is the fact that the bell and the operating knob may be combined to form an emergency drinking cup or receptacle for putting water in the radiator. The Handphone, which is a product of the Automobile Supply Mfg. Co., Brooklyn, N. Y., operates on the plunger principle; the Heco, which is manufactured by the Heinze Electric Co., Detroit, Mich., employs a spirally-cut plunger. This company also makes a horn under the same name especially for trucks which produces a long, rolling note. The Evergood, made by the Emil Grossman Mfg. Co., Brooklyn, N. Y., is another horn built specially for truck use, operating by a vertical plunger.

An Underhood Hand Horn

Some of the leading manufacturers of hand horns who continue their standard models are: Lovell-McConnell Mfg.

Co., whose hand Klaxon is a vertical plunger instrument while the hand Klaxonet has a horizontal plunger operated from the rear; the Fitzgerald Mfg. Co., Torrington, Conn., producing the two Clero models, the long projector types being for use on any car while the short projector style is especially for small cars; the Nonpareil Horn Mfg. Co., New York City, which makes the Pilot in two styles with either horizontal or vertical rotary handle working in either direction and also in an underhood type, operated through a 36-in. cable. This company also makes the Noxal ratchet principle hand horn. The Talking Horn Co., Middletown, N. Y., makes the Double-Warning, which is operated by pulling a strap, the signal being repeated when the strap is released. This horn may be mounted either close to the driver or at some distance where it may be operated by a leather cord.

Combined Horn and Fan Styles

There are two leading examples of the combined fan and horn type of construction, these being the Oakes Co., Indianapolis, Ind., which manufactures the mechanically-controlled Beartone for Ford cars, and the Marvel Accessories Mfg. Co., Cleveland, Ohio, which makes the Marvel, using a diaphragm in the hub with a lever-operated vibrating mechanism.

Bulb horns combined with electric types are made, among others, by the Lovell-McConnell Mfg. Co., Newark, N. J., in Klaxon and Klaxonet styles, and the American Electric Co., Chicago, Ill., which makes the Samson.

Exhaust-Operated Types

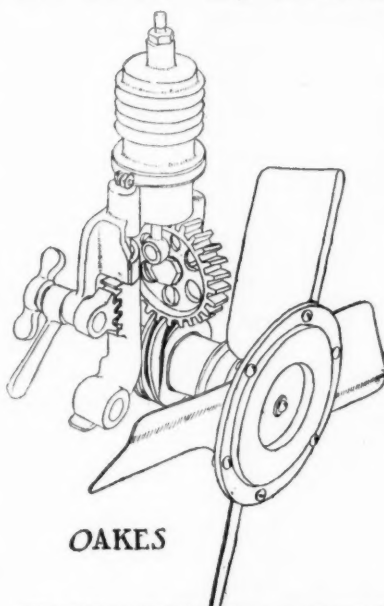
There are a number of exhaust-operated horns on the market, some of the leading instruments of this type being: Gabriel, made by the Gabriel Horn Mfg. Co., Cleveland, Ohio; Aermore, Fulton Co., Milwaukee, Wis.; Gemco, Gemco Mfg. Co., Milwaukee, Wis.; Autochime, Gray-Hawley Mfg. Co., Detroit, Mich.; Nightingale, Riley-Klotz Mfg. Co., Newark, N. J.; and Barco Chime, Barco Brass & Joint Co., Chicago, Ill., and Princeton combination horn and cutout, S. B. R. Specialty Co., East Orange, N. J.

Two Bell Signals

Two of the leading bell type warning signals on the market are the Liberty Bell, made by the Liberty Bell Co., Cleveland, Ohio, and the Trinity Bell, Trinity Bell Electrical Mfg. Co., Chicago, Ill. These signals are rigidly mounted bells having electrically-actuated clappers, and embody other features such as a small red light, which is switched on while the signal is operated, semaphore direction signals, emblems, etc.

Cow Driver Secures Judgment of \$150 Against Motorists

Judgment was recently rendered against a motorist for \$150 in Alabama. A woman who had been run down and injured while driving a cow and a calf along the highway sued a motorist for her injuries. The court held that as she was giving her entire attention to the animals she was driving, and did not notice the automobile approaching from the rear, she should be given judgment, as travelers on a public highway owe a duty to others traveling on the highway, which duty requires them to so reasonably conduct themselves in the use of the highway that they will not injure other people on the highway.—*Dozier vs. Woods*, 67 South (Alabama) 283.



The Oakes Beartone is a mechanical horn operated directly from the fan and controlled by a button

Many Types of Spark Plug

Spark Plugs Have Reached a Stage of Marvelous Reliability, Insulators Are Improved and Life Increased

IT is difficult for a layman to tell the difference between one spark plug and another. For each a special claim is made, some are designed to work particularly well in certain sorts of motor, as instance the long patterns which are made for Ford cars. Others have their chief feature in some device intended to prevent short-circuiting by reason of oil accumulation, but there are two main things the maker of a spark plug strives for. Of these the first is the evolution of means to hold the insulator absolutely tight in the shell so that neither when new nor when old will there be any leak through the packing, and the second is to find an insulator which will withstand the high temperature of the modern type of high-speed engine without injury. There may be added the necessity for sparking points which will not burn away quickly and the desirability for so shaping the insulator that its exposed end shall be as difficult as possible to clog with oil or carbon.

Insulating Materials Improved

Insulating materials such as are now used have taken years to discover, and every year almost, they are improved. Porcelain insulators are no ordinary china factory production, they need to be made of special clays and by special processes. Thousands upon thousands of plug porcelains used to be imported from Europe, prior to July, 1914, and the American market has had to turn around and find home sources of supply. It has done so successfully and to-day the American plugs, better than ever before, are all-American.

High Motor Speeds Make Trouble

Also, increasing motor speeds spell increased average temperature in the cylinder; the plug points and insulator have less time to cool off between each explosion, and this has made the conditions of plug operation more arduous. Better insulators, tighter packing and larger electrodes have been made necessary. All these troubles have been tackled by the manufacturers, have been overcome and done away with, but it has needed much difficult work to bring this about.

It is possible to take the drawings of a motor and to deduce with reasonable accuracy what the performance ought to be. It is not possible to do the same by a spark plug, the differences between one and another are too small on the surface. Inspection does not show how well the packing is done, how impervious to moisture is the porcelain, how high may be the resisting power of the points to burning.

All Plugs Good Value

Plugs may be bought in two ways, on price and on recommendation. It does not always follow that a particular motor will perform any better with expensive plugs than with cheap ones, but a fairly general rule is that really cheap plugs will not give good service in a high-speed engine. In an old motor the expensive plugs may give longer life, but often the cheap ones perform equally as well, and susceptibility to oil has often more to do with design than with material and workmanship in the plug. The high-priced plug is like the high-priced car, it is just as well worth its price as the cheaper type, but the latter is capable of giving excellent satisfaction and of returning an equally full value for the money expended.

Mention has been made of porcelain as an insulator, but this is far from being the only material used, or even the predominant material. In addition there are many mica insulated plugs and many with insulators of natural or artificial stone. The latter might reasonably be classed as a variety of porcelain so, if a division is desired, it might be made by calling porcelain and stone insulated plugs the solid insulator type and so contrasting them with the mica pattern, for mica is obtained in thin sheets and has to be made into insulators by the compression of many small pieces threaded upon a core. The customary method is to punch minute washers from the sheet, to thread them upon the central electrode and clamp the lot together with a nut, a process of heavy compression preceding the final assembly.

Mica and Porcelain Equivalent

It is only possible to generalize in a very broad way, but the most obvious point in favor of mica is that a plug which uses it is less liable to accidental injury, since it cannot very well be chipped or broken by a blow. The stone or porcelain insulator is a little easier to make waterproof and is a simpler manufacturing proposition, once the plant for making the porcelain itself is got in proper shape. There is much argument as to the effect of heat on the two insulating materials and it is worthy of note that racing car drivers are not yet agreed, nor has it ever been settled that either one or the other was always the better for aeroplane motors; and the aeroplane engine provides about as hard a test for plug qualities as can be found.

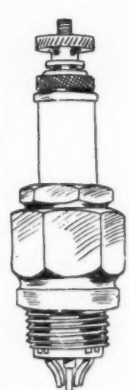
Many Styles of Gap

Another thing which has been productive of much discussion is the relative value of single point electrodes giving but one path for the spark, and multi-point constructions providing two paths or more. There are more single point plugs in use but this does not necessarily prove anything. The single point pattern is easy to clean and is easy to adjust always, and the same applies to many multi-point designs, though not to all. The argument for the multi-point is that when the spark has burned away the two points that are closest together it can go to the next pair and so, by distributing the wear, the time for setting the points will be postponed, but this can be done with single points by increasing their size.

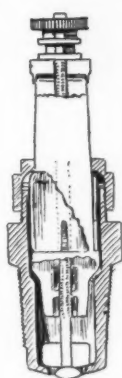
Avoiding Shorts

To prevent shorting it is now an almost universal practice to keep the lower end of the insulator well within the shell of the plug and to give it a wide contact with the shell so that it has opportunity to part with its heat, for the cooler it is kept the slower will carbon deposit upon it. This year it is noticeable that insulators are larger and have a greater area than formerly, this being testimony to the harder conditions under which they are now asked to work.

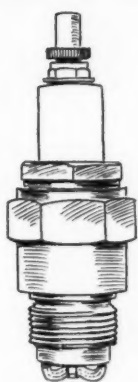
One of the surprises of the year has been the way in which racing cars managed to overcome plug trouble which, early in the season, was their most serious difficulty. This was done partly by alterations in the motors, but the credit belongs entirely to the spark plug manufacturers, for so speedily tracing the trouble to its source and finding the remedies.



BETHLEHEM



RADIUM



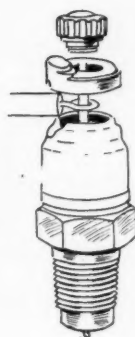
JUMBO



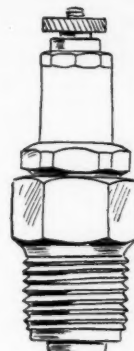
J-M



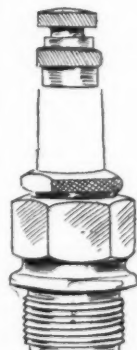
HERCULES



PROMOTOR

CHAMPION
RELIANCE

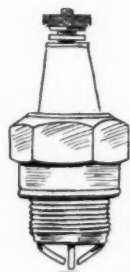
MC CORMICK



ECLIPSE



V-RAY



WESTERN ELECTRIC



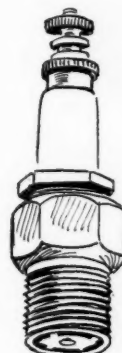
AUBURN



BETHLEHEM



BETHLEHEM



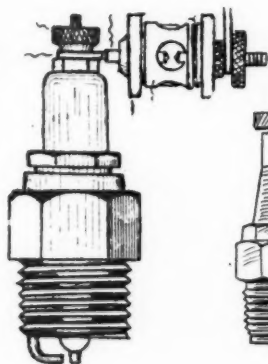
MOSLER



BOSCH



SUDIG



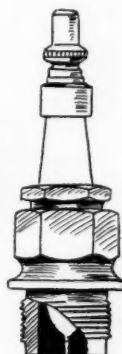
PRONTO



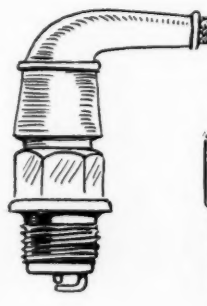
KINGSTON



CHAMPION



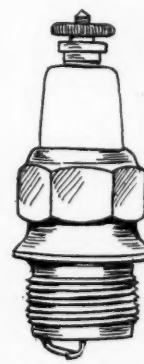
PANTHER



RAJAH



MOSLER



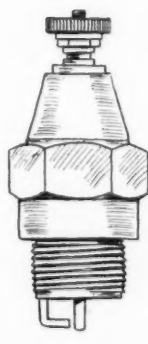
TITAN



CHAMPION



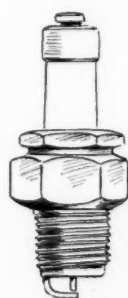
CHAMPION



ANSWER



WRIGHT



RAJAH



EZEKLEEN



REDHEAD



Spark plugs can be divided into two simple classes by grouping those with single point spark gaps and those in which the spark has a choice of route. The sixteen plugs illustrated on the upper half of this page show many different ways of providing more than one spark gap. The sixteen in the lower half of the page are all of the single gap type. Observe the great variation in the shape of the insulator.

Improving the Suspension

There Are Very Many Devices Intended to Assist the Action of the Springs and so Give Greater Comfort in Riding. Wide Variations in Price and Complexity Are to Be Observed

THE term "shock absorber" is commonly used to describe two fundamentally different types of mechanism. The function of a car spring is to give under sudden shocks, and the reason coil springs are not used is that they would give too readily and rebound too vigorously. The leaf spring acts more slowly, because of the friction between the leaves which damps the action, and the true shock absorber is a frictional attachment which, when placed between the frame and axle of a car, will add to the amount of friction inherent in the leaf spring.

Now, a leaf spring with or without a shock absorber has a natural sluggishness which is deliberately sought and is necessary, but this sometimes is not entirely an advantage. Short, sharp shocks are possible which come too quickly and are over too soon for the leaf spring to begin to operate, for such shocks as these we need a greater flexibility.

Supplementary Spring's Purpose

To meet this condition there was created the supplementary spring idea which adds a flexible spring of small amplitude to the end of the leaf spring. Usually a coil spring is employed which, having no lag in action responds instantly to a shock of any size, cares wholly for a small shock and eases the beginning and end of a large shock which is heavy enough to disturb the leaf spring.

There is no reason whatever why a car should not have both shock absorbers and supplementary springs fitted to it, for the functions of each are different, and there have been a few devices designed which combined both principles.

Two Types of Shock Absorbers

Shock absorbers divide into two types also, for some are intended to offer frictional resistance to both the compression and the rebound of the leaf spring, while others are so designed that they move without friction on the compression and only exert restraining force on the rebound.

It cannot be too clearly understood that the use of aids to spring action, whether shock absorbers or supplementary springs, is no reflection upon the original leaf spring. The leaf spring is essentially a compromise affair. Considering its simplicity it is wonderful that it acts as well as it does. Almost any spring is the better for a shock absorber, as it helps it to resist the abnormally large shocks, and it would be wrong to design a leaf spring solely for big blows to the neglect of the little ones.

Similarly, the supplementary spring has its place at the other end of the scale; it cares for shocks too small to affect the leaf spring, so small that a leaf spring could scarcely be designed to absorb them. One might almost regard the effect of the supplementary spring as similar to that of doubling the tire section or of lowering the pressure in the tire.

In the design of shock absorbers the ideal is to provide an easily adjustable amount of friction and frictional surfaces which will be lasting. Also easy attachment is a thing that has had to be studied, and provision made to prevent rattle developing after long use. Each maker has worked out the problem in a different way and all sorts of different

ways have been adopted for creating the friction desired. In some instances we see the simple case of two plates or disks gripped together, a sort of diminutive disk clutch. In others the friction of an expanding piston inside a cylinder is used. Others again have a liquid inside which is forced to pass through a small hole.

Different Systems Similar Effects

Each design has its special claims, but there is no reason why they should not all prove equally effective if the mechanical excellence is equal and the proportions are equally well chosen. Design and workmanship count about equally, and there are plenty of shock absorbers having both these qualities highly developed.

Supplementary springs also vary a great deal. We are limited in the range of action that can be allowed by the distance between the frame of the car and the axle, so the travel of a supplementary spring cannot be very great in any case, but having this limitation we can use springs of many types. Some devices are single coil springs, others are duplex, others again use a strong coil spring with a short range and add multiplying levers to increase its amplitude. Some others do not use coil springs of the conventional type, but employ volute springs, or single leaf springs in a flat coil like a clock spring.

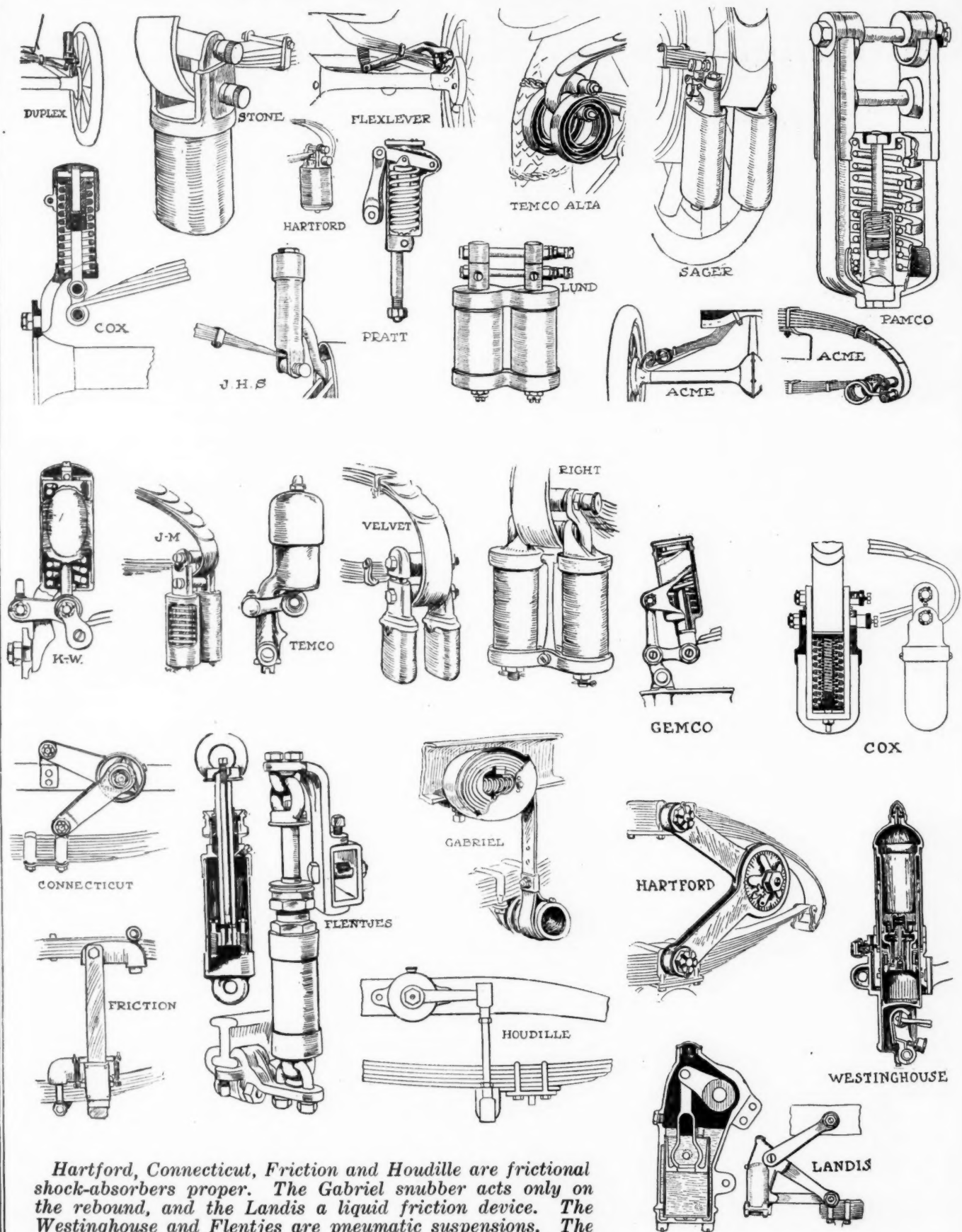
Springs Need Protection

Here again, just as with the frictional spring dampers, the variations in design represent different ways of working out an engineering problem. First, the spring must be properly proportioned to the work it has to do, to the weight of the car and the amplitude of travel. Then any slides or pivots used must be protected against dirt and grit which would cause wear and perhaps squeaking. Lubrication is a little problem by itself, and many ingenious schemes have been evolved to care for it with a maximum of effectiveness and minimum of trouble.

Air Springs Separate Class

There remains the air spring which is an attempt to combine the functions of damper and supplementary spring as well. It is possible to design an air spring which will have all the elasticity of compressed air for absorbing small shocks, and will care for shocks also by the bringing into action of an automatic damping device which puts in frictional resistance in proportion as the violence of the shock increases. Such suspensions have been designed entirely to replace leaf springs, but they have the drawback of being rather clumsy and difficult to work in with an automobile chassis of conventional design.

The air spring can be adapted as a supplementary spring simply, and there are sundry devices of this nature, and it can be also made in such a way that when attached to a leaf spring it is supplementary and shock absorbing also. Probably cost has stood mostly in the way of a much wider use of this variety of attachment, and the air spring may yet have a future before it. To use it most effectively means designing the chassis to suit it.



Hartford, Connecticut, Friction and Houdille are frictional shock-absorbers proper. The Gabriel snubber acts only on the rebound, and the Landis a liquid friction device. The Westinghouse and Flentjes are pneumatic suspensions. The remainder illustrate different sorts and applications of supplementary springs.

Fundamentals of Electric Equipment

Functions of Various Parts and Sundry Questions of Design Discussed

By Joseph Bijur

(Concluded from page 90)

AS to generator size, if a certain output is wanted at a speed of say 1000 r.p.m. and under other circumstances the same output were to be required at a speed of 500 r.p.m., the slower-running generator would have to be substantially twice as large as the faster-running machine. Conversely, the higher the speed at which the generator may run when it must furnish a certain current, the smaller and cheaper the machine can be. Roughly speaking, the bulk and cost of a generator come down in proportion to the rise in speed at which it is considered necessary for the generator to furnish any given output. This speed is usually found to be that which can be counted on in the hands of a typical driver who is occupied in business pursuits during the day and has time to drive the car only in the evening. Under these conditions no daylight charging can be counted on. For all stops during which the generator is idle and the lamps are turned on, full compensation must be provided. For all of the minutes during which the car is run at a speed when the generator output is less than the current consumption, this deficiency must be made up. Therefore, in order to keep the battery from becoming depleted, the average current supply of the generator must at least equal the average consumption; as a matter of fact it must exceed the consumption, because it can be taken roughly that in order to keep a battery full, the input to the battery must be 25 per cent higher than the output from it. In considering this question we not only have to deal with the current consumption during the periods when lights are left burning, but to take into account the current consumption from starting, as well as the "phantom" load of leaving the car standing idle. During such periods there is a loss of charge in the battery which has to be compensated for exactly the same as if current were taken out of it. From these considerations the following reasoning may be taken. A car driven at night can be counted on to average not over 14 m.p.h. Often this average is taken at 12 m.p.h. If the figure that we consider is 14, then we assume that the current generated during the time when the

speed exceeds 14 m.p.h. will compensate for the battery drain of standing, starting and battery loss during periods of no car operation. If the lamp load is assumed to be 8 amp., and the generator current is assumed to be 10 amp. at 14 m.p.h., then for this average speed the generator is supplying 2 amp. more than the current consumed, which excess can be used to compensate for the battery losses above referred to.

If the regulation is such that the current does not ever rise above 10 amp., this amount would be insufficient for a lamp load of 8 amp. and a higher current value would be necessary—something like 14 or 16 amp. constant would be nearer right. This current, however, might greatly overcharge the battery on a car usually operated in daylight hours. Assuming that the regulator is such that for speeds above 14 m.p.h. a higher current will be generated, the value of 10 amp. at 14 m.p.h. would probably suffice. In either event, we see that one of the most critical factors in the adequacy of the generator for its work is its capability to deliver a current in excess of the lamp current at the slow average of night driving. In the example just considered it was essential that the generator should deliver 10 amp. at 14 m.p.h., and assuming that the generator and engine are so arranged that on high gear the generator makes 70 revolutions for each mile per hour of car speed, then it was essential that the generator should deliver 10 amp. at a generator speed of 14 times 70, or 980 revolutions. This is substantially the determining factor in the generator size. If it were adequate to have the generator deliver only 6 amp. at 980 revolutions, or if it were satisfactory to have it deliver 10 amp. at 1200 revolutions, such machines could be made smaller than the one first cited.

Cut-In Speed Not Important

From a consideration of the foregoing it will be evident that the speed at which the generator is connected to the battery and begins to deliver some current, is of relatively small importance. This speed is popularly known as the cut-in speed and refers to the point at which generator charge begins. To understand this

better, considering the case first cited, and assuming the generator cut-in point to be at 9 m.p.h., the generator current output will be about as follows:

9 miles per hour	0
10 miles per hour	2 amperes
11 miles per hour	4 amperes
12 miles per hour	6 amperes
13 miles per hour	8 amperes
14 miles per hour	10 amperes

When driving at 13 m.p.h., the generator output only equals the lamp load and no surplus remains to take care of the other battery losses. At speeds below this, the generator output is deficient by greater and greater amounts. It can now be seen that whether this cut-in takes place at 10 m.p.h. or at 4 m.p.h., no assurance can be derived from it that the generator supply will be equal to the demand. It is only the speed at which the generator supply exceeds the load by the desired amount, that is the determining factor in considering whether or not the generator will keep the battery full.

In connection with low cut-in speed, at the point of cut-in, armature reaction has not yet come into play, since the armature only begins to deliver current from here on, and the current is zero or nearly zero. The cut-in point is often determined as the speed at which the generator gives a voltage equal to that of a fully charged battery, or about 7 volts. At this point the resistance of the armature does not come into play, because no current is being carried, and therefore no resistance drop takes place. We can then in a generator get a low cut-in point by disregarding armature reaction and armature resistance and simply wind the generator armature with many turns of fine wire. Such an armature generates the requisite of 7 volts at a low speed and furnishes the low cut-in which has often been desired. The high resistance and high reaction of such an armature operate against its promptly delivering more current with slight increase in speed, since as soon as the current becomes nearly equal to the lamp load, a large armature loss from these two factors results, and the machine, which has been built particularly to give a low cut-in point has to have its speed raised inordinately in order to furnish the critical current at the minimum speed.

Factors that affect the minimum size of generator are the permissible heating and the permissible sparking at the brushes. The heating is proportional to the resistance and to the square of the current. Therefore, for larger currents we have to wind armatures with larger wire and if the number of turns is still the same as it is if the speed remains the same, then armatures that provide room for this larger wire, and consequently the whole machine, must be larger. As to the sparking at the brushes, this may be a determining factor, but usually is not when the design of the machine is along the lines of low armature reaction without reference to early cut-in speed.

Passing now to the subject of starting motors, we utilize the tendency of a conductor lying in a magnetic field to move at right angles to its length when it is traversed by electric current. This force is proportional to the strength of the magnetic flux and to the value of the current. The characteristics required of starting motors are well met by making them series motors in which the entire current passes around and magnetizes the field before entering the armature. In such motors, if the iron did not become saturated with magnetic lines, the pull would increase proportionally to the magnetizing current and therefore to the flux, while the pull due to increased current in the conductor would increase due to this current alone, so that the resultant of increase both in flux and in current would produce a pull increasing as the square of the current. However, we have to deal with iron in which the magnetic flux does not increase proportionally to the current, on account of the iron becoming saturated, so that the pull of starting motors varies more nearly in direct proportion to the current over a large part of their useful range.

Starting Motors

In general, for any given amount of horsepower required, the size of a motor diminishes as the permissible speed goes up, but at the same time many losses arise with speed, such for example as the loss due to friction of the brushes on the commutator, and the loss from the reversal of magnetism or hysteresis in the armature, and other losses due to stray or eddy currents in the armature conductors and in the faces of the magnetic poles. Where the work is large, it is often desirable to take advantage of the possibility of high speed by using a motor which, instead of acting on the fly-wheel direct, is geared-up so that the ratio between motor and engine shaft approximates 30 to 1, or even higher. However, where the engine is small and the work to be done less, the cost and extra parts of gearing are not warranted in view of the smaller and smaller saving to be made in the motor as its size goes down, and in view of relatively large

losses in gearing and bearings, so that it has come about that geared-up motors are used to crank the larger engines, whereas for small engines, or for those for which less cranking ability is required, direct-acting motors are employed working with ratios in the neighborhood of 10 or 12 to 1. For such motors, it is desirable to have the ratio as high as possible in order to utilize the benefit of higher motor speed and so diminish motor size and cost, for which reason it is better to be able to use a ratio of 12 to 1 than one of 9 to 1; a motor employing the higher ratio would be about three-quarters as large as a motor employing the lower ratio.

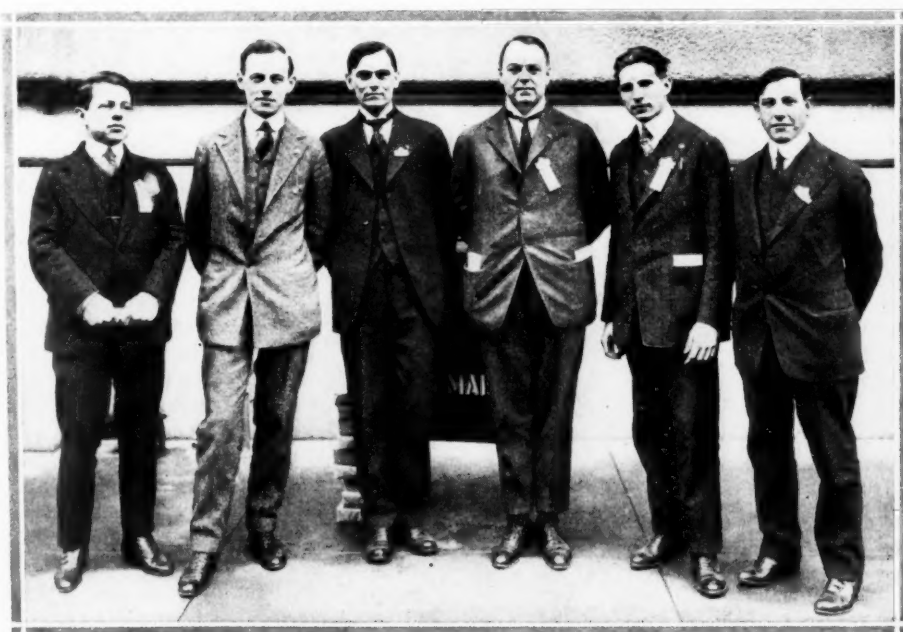
The power required to crank an engine depends greatly on the temperature since as the temperature falls, the viscosity of the oil increases, offering much greater resistance to turning. Under the conditions that prevail at present, the prime requirements seem to be that the motor should be able to break the engine loose at whatever temperature is fixed upon as being reasonably low and that at this temperature it should be able to crank the engine fast enough to make ignition readily take place. Experience has shown that starting is not obtained as easily when the engine is turning over only say 12 r.p.m. as when it is being cranked at 60 r.p.m. This is for a variety of reasons, including the difficulty of drawing in the proper mixture at very low speeds and the excessive dissipation of the heat of compression at low speeds. Therefore the starting motor has to be proportioned with these conditions in mind.

If it is feasible to ascertain the torque on the crankshaft required to break the the engine loose, and if the torque re-

quired to keep it turning at a given temperature is also known, and if the ratio between motor and crankshaft is fixed, the adequacy of a motor can be determined. In fact, the relative performance of motors can be considered best by assuming that the torque required is the same and considering the other conditions which prevail at various values of torque. In most cases the torque is fixed by the engine and the possible gear ratio, and it is frequently known exactly or from comparison with other engines; in which case, if the motors can be compared on the basis of torque, the performance of motors in connection with the engine can be closely predicted, and the relative qualities of motors more easily determined.

Characteristics of Starting Motor

A convenient chart for comparing motor action is shown in Fig. 1, which has the results from a certain motor plotted on it. On this chart the abscissae are the values of torque in pounds-feet and the ordinates the revolutions per minute of the electric motor. On the same chart other ordinates are laid out. The column on the left immediately next to the column of speed relates to brake-horsepower. The next column relates to volts measured at the motor terminals. The next column refers to the electrical efficiency of the motor when converting electrical into mechanical power. The right-hand column relates to amperes. To further explain this chart, the speed of this particular motor when it had a pull or torque of 2 lb.-ft. was 1600 revolutions and with double the torque, or 4 lb.-ft., the speed dropped to 1140 revolutions. At 6 lb.-ft., the speed was 910 revolutions and at 16 lb.-ft., dropped to 260.



Section Secretaries of S. A. E. From Left—W. H. Conant, Detroit—B. B. Bachman, Pennsylvania—R. C. Combs, Indiana—Coker F. Clarkson, General Manager S. A. E.—J. E. Schipper, Metropolitan—D. S. Hatch, Mid-West

The value of the volts at the motor terminals and the other data corresponding to these torques are shown by the remaining curves. Thus, for the torque of 8 lb.-ft., where the speed is 740 revolutions, the amperes, by referring to the proper column, are 280, the horsepower is 1.13, the efficiency 57 per cent and the volts at the motor terminals when this torque reading was obtained, were 5.15. In connection with this latter, it has been found useful to approximate in these tests the voltage at the motor terminals which prevails on automobiles under service conditions. There will, of course, be some difference according to conditions of tests, but a comparison between motors can be made if these conditions are assumed at approximately sensible values.

The motors are tested with the voltage at the terminals regulated to lower and lower values as the current rises. The following table will serve to indicate the voltage that can often be expected at the motor with various values of current flowing into it. The reason for the increasing drop with rising current has been referred to in considering the storage battery, and to the battery drop there must be added the increasing voltage loss in the leads and connections between battery and motor.

Amperes Into Motor	Volts Assumed to be Maintained at Motor Terminals
30-40	6
100	5.7
150	5.6
200	5.4
300	5.1
400	4.8
500	4.4
600	4.0
700	3.5

Similarly, the performance of another direct-acting motor of smaller size is shown in Fig. 2. Considering the larger motor, as shown in Fig. 1, the highest torque obtainable is 21.8 lb.-ft. with 630 amp., which flow as a result of 3.6 volts across the motor terminals. In other words, the locked torque is 21.8 lb.-ft. Assuming a gear ratio of 12 to 1, this corresponds to a torque of 262 lb.-ft. on the crankshaft to break it loose. If we assume that around 60 revolutions is the lowest point at which starting will take place readily, then on the curve we look for about 720 revolutions of motor speed and find that the motor speed drops to 740 when the torque rises to 8 lb.-ft. In other words, this motor will develop 96 lb.-ft. at the crankshaft before the engine revolutions drop below 62.

Cranking Torque and Speed

The torque needed to crank in cold weather may often be taken as about three times the torque required under ordinary conditions (around 70 deg. Fahr.), and if it is desired to provide for extreme cold, an assumption that the torque will be four times as great is usually not far from correct. Making this latter assumption, if the torque for

the slower cranking was 8 lb.-ft., then the normal torque would be 2 lb.-ft., corresponding to a motor speed of 1610, or with a ratio of 12 to 1, about 134 crankshaft revolutions.

Putting the matter in a different order, we find that this motor when geared 12 to 1 would perform about as follows: Applying 24 lb.-ft. on the crankshaft it will spin the engine at the rate of 134 revolutions with a current of 108 amp., if the volts across the motor terminals are 5.7. At four times this torque, developing 96 lb.-ft. on the crankshaft, it will crank the engine 61½ revolutions, taking 280 amp., if the volts at the motor are 5.15; and before it can be stalled, it will apply 262 lb.-ft. on the crankshaft to break loose a cold engine.

Torque and Current

To grasp readily the difference between a large and a small motor, or rather to see readily what sacrifices are made as the motor is made smaller and cheaper, we will assume that the smaller motor is applied instead of the larger one, all other things being left the same. The gear ratio, which we would like to have increased above 12 to 1, cannot be increased by merely making the motor smaller, since the gear ratio is usually dependent on the size of the flywheel gear compared to the motor pinion and is not affected by the motor size. Examining the curves of the small motor (Fig. 2) and taking the same values of torque, we find that it will develop 24 lb.-ft. on the crankshaft with a cranking speed of $1880 \div 12 = 157$, using 160 amp., if a voltage of 5.6 is maintained at the motor terminals. For a crankshaft torque over 96 lb.-ft. it is entirely inadequate, and assuming the curve of revolutions to be prolonged, it would crank with a speed of about $324 \div 12 = 27$ engine revolutions, with a current of 435 amp., if 4.6 volts were maintained at the motor terminals. Before the engine stalls, it will develop on the crankshaft 11.6×12 , or about 140 lb.-ft. to break the engine loose.

We see from this comparison that the little motor would actually crank the free-running engine in a moderate temperature, when the torque was 24 lb.-ft., faster than the large motor, but this is now shown to be no indication whatever of what the cranking will be in cooler weather. In order to do the cranking under easy conditions, the small motor uses considerably more current than the large motor. The small motor performance falls away down as the load rises; the motor is incapable of exerting anywhere near the breaking loose effort afforded by the larger motor.

A further comparison between large and small motors can be made as in Fig. 3, where I have superimposed the curves showing revolutions, amperes and horsepower, but omitted the curves of effi-

ciency and voltage to avoid confusion. On Fig. 3 the curve for the large motor is shown in full lines and the curve for the small motor in dotted lines. One of the first things we notice is that for all torques the current used by the small motor is greater than the current used by the large motor. Another point is that the locked or stalled torque of the large motor is about twice that of the small motor. Looking at the horsepower curve we see that the small motor exerts its greatest horsepower when its torque is about 5 lb.-ft.; whereas the large motor exerts the maximum horsepower at nearly twice this torque, or 10 lb.-ft. As far as speed is concerned, cranking by the small motor is faster than that by the large motor when the torque is less than 4½ lb.-ft., or 54 lb.-ft. on the crankshaft, but for torque beyond this, the large motor is far superior, and if the critical speed of cranking is taken at 50 revolutions, which is a commonly used value, the small motor will sustain this speed so long as the cranking effort does not exceed $6\frac{1}{2} \times 12$, or 78 lb.-ft.; whereas the larger motor will crank faster than 50 r.p.m. until the cranking effort has risen to 10×12 , or 120 lb.-ft.

In connection with these curves, it may be noted that in most cases, until the size of the motor is forced down to the smallest possible, the locked torque is usually not the limiting factor, if the condition for cranking a cold motor at adequate speed has been met; that is to say, any motor which will crank fast enough with a reasonable current consumption under cold weather conditions, usually has sufficient locked torque to break the gas engine loose. Of course this is only a generalization and does not always apply. In practice, it has been the speed of cranking in cold weather that has limited the size of the motor in most cases, rather than the ability to break loose.

Determining Motor Size

With curves plotted in this manner, it is a comparatively short undertaking to determine the smallest motor that will meet any conditions laid down, as a cranking test can be made on the engine with any motor, although preferably with one about the size likely to be used. From this test the cranking torque of the gas engine is determined and the probable cold weather torque anticipated, and from these data a motor of the minimum size can be selected or designed with tolerable accuracy.

Single-Unit and Two-Unit Systems

If the operation of the two-unit system is clear, the functioning of a single-unit system will be understood more easily. I am referring now only to the simplest of the single-unit systems, in which we have a motor-generator directly connected to the crankshaft with a ratio

of about 3 to 1, usually through a silent chain. Not only is the motor-generator driven at about twice the speed at which an ordinary generator would be used, but it is a large machine whose armature has larger inertia and whose drive is subjected to considerable strains in cranking which do not occur when the drive is to a generator alone. The reason for the high ratio is that a machine of this kind needs, as a motor, as high a ratio as it is feasible to obtain. We have already seen in the consideration of the two-unit systems that the generator is suitably driven from many engines when its speed is $1\frac{1}{2}$ times crankshaft speed, whereas the motor is well geared when its ratio is about 12 to 1. It is, therefore, obvious that in the motor-generator we tend to gear it higher than the generator, which accounts for the fact that it should run at about three times crankshaft speed.

It is characteristic of single-unit systems that for cranking they usually develop a lower locked torque on the crankshaft as compared with the same weight of apparatus arranged in the two-unit system. For equal weights, the single-unit system while somewhat deficient in

the locked torque, is also somewhat lacking in ability to crank a cold motor around 60 revolutions, but the difference between the single-unit and two-unit systems is not as great as generally supposed.

It is characteristic of the single-unit system, operating with constant engine ratio and with only one armature winding, that it is most efficiently operated at 12 volts; whereas the two-unit system is perfectly satisfactory at 6 volts. A large part of this difference is due to the characteristics of the brushes required for good operation as a generator, which must also serve as motor brushes when the machine is cranking; whereas with the two-unit system the motor can be designed without any reference to the generator, and thus adequate provision made to keep the losses small on a 6-volt system.

In discussing Mr. Bijur's paper several of the members commented on the fact that the voltage regulation should be sufficient. It was pointed out that a lighting concern would be put out of business by the public service commission if a variation in voltage amounted to 5 per cent. Good results, it was said, cannot

be expected without constant voltage. It is a difficult matter to exactly regulate voltage, but this regulation should be attained if possible.

H. W. Slawson asked what would happen to the battery due to a continuous overcharge. To this L. B. Brown replied that while he could not give any exact information he thought that it would be possible to get it from the Delco men who had abandoned the ampere hour meter and could probably tell why. Mr. Kettering of the Delco company said that while the ampere hour meter was good in its way and did the work he knew of one instance in which the engineer had cut off its hands. He further stated that if it were not for the different kinds of drivers the entire work of design would be easy.

A. D. Libby made a plea for smaller units. During the past year the electrical equipment on our cars has been becoming larger. Mr. Libby said that he had made some tests in which he had reduced the lamp load from 7 amp. to 3 and secured twice as much illumination. The loads can be reduced, he said, and therefore the cost merely by efficient design, proper focusing, etc.

Safety Control for Electric Vehicles

SAFETY is sometimes better secured by engineering than by legislation. By a simple change in the control mechanism of all its electric trucks, the department of welfare and safety of the Eastman Kodak Co., Rochester, N. Y., has effected an infallible safeguard against the cause of many serious accidents.

The illustrations show one of the devices mounted in a box similar to a driver's seat in the rough. The driver sits at the left side of the box, operating the control lever with his left hand. The rheostat selector shaft, to which the controller lever is attached, also carries a sector which prevents the operator from engaging the switch except when the selector is at the neutral point. A lever has been attached to the main switch from which the handle has been removed

and this lever has a pawl while there is a slot in the sector through which the pawl on the lever actuating the switch must pass in order to close the switch. The sector is so located that when the switch is closed, the rheostat selectors are all at the neutral point. As the pawl is held forward by a pressure spring, the switch lever can disengage the switch at any position of the selector.

Starting with the controller lever at neutral and the switch open, as in Fig. 1, the switch may be closed, as in Fig. 2, the pawl slipping through the slot in the sector, and passing clear through so that the controller may be moved to any desired notch. If the switch be opened, say in one of the reverse notches, as in Fig. 3, it cannot again be closed until the controller lever has been moved to neutral position.

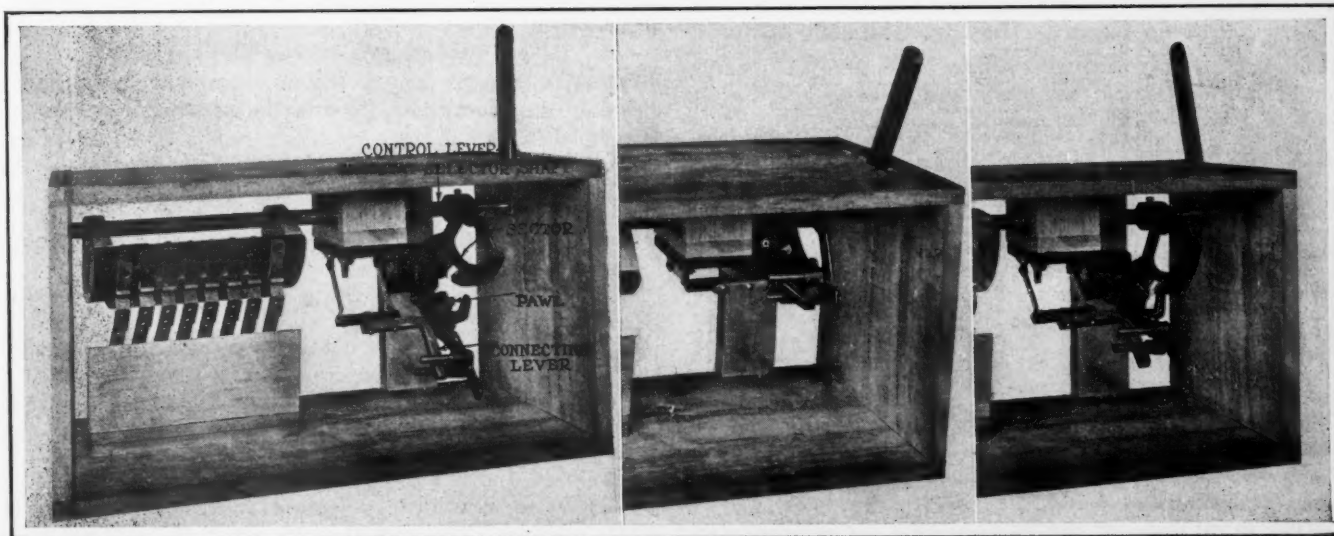


Fig. 1

Fig. 2

Fig. 3



The Rostrum

Fitting Flanders Camshaft Bearings

Editor THE AUTOMOBILE:—The following questions are relative to a Flanders 20 model 1912, motor 3% by 3%, L-head centrifugal water pump.

1—Can aluminum alloy pistons be used to advantage on this car? If so, what clearance should they have?

2—Would you advise using the hour-glass type or the wiper-ring type as used on the King? This car uses four rings, one of which is a wiper, the oil system being the vacuum splash. Would you use the same number of rings as on the cast iron piston?

3—Will the additional clearance for alloy pistons cause much oil pumping, at low speeds, without a wiper ring?

4—Can a slightly scored cylinder be repaired without being rebored?

5—I want to fit new camshaft bearings, middle and rear end. I have an old camshaft and would like to know if it would be practical to lathe off say 0.002 in. of these bearings of the old shaft and cast bearings from Fahrigh metal right into place. Of course the middle bearing would have to be cast split so that it could be removed, scraped and replaced with the new shaft.

Stephens City, Va.

E. E. C.

—It is doubtful if the introduction of aluminum alloy pistons to a model as old as this would be justified. There are so many other features of design which govern the speed of a motor that the use of aluminum pistons in a motor of 1912 would not have any appreciable effect.

2—This is answered under question 1.

3—While the initial clearance of alloy pistons is greater than that with cast iron the greater expansion of the aluminum soon compensates for this. The number of rings would be about the same as on the cast iron type.

4—A slightly scored cylinder can be remedied by lapping or grinding.

5—New bearings can be cast in place, but this is a job which requires skill and practice.

Racing Records Held by Oldfield

Editor THE AUTOMOBILE:—Kindly give me the records held by Barney Oldfield and officially allowed by the contest board of the American Automobile Association.

Yonkers, N. Y.

C. W. L.

—The following tabulation gives the records held by Barney Oldfield to date:

Speedway Records Regardless of Class					
20 miles	— 13:58.14	Oldfield	Stutz	Indianapolis, May 30-14	
25 miles	— 17:30.40	Oldfield	Stutz	Indianapolis, May 30-14	
5 miles	— 4:01.36	Oldfield	Knox	Indianapolis, May 30-10	
5 miles	— 3:38.61	Oldfield	Knox	Los Angeles, Apr. 16-10	
10 miles	— 7:20.66	Oldfield	Knox	Los Angeles, Apr. 16-10	
1 mile	— 40.53	Oldfield	Benz	Daytona, March 16-10	

Firing Orders of Typical Twelves

Editor THE AUTOMOBILE:—Please publish the firing order of a few of the standard twelve-cylinder motors.

Richmond, Ind.

R. N. L.

—The firing order of the Packard twin six is 1R-6L-4R-3L-2R-5L-6R-1L-3R-4L-5R-2L. The letters R and L refer to right and left cylinder block, respectively.

The firing order of the National twelve is 1R-6L-5R-2L-3R-4L-6R-1L-2R-5L-4R-3L.

The firing order on the Enger is 1R-1L-5R-5L-3R-3L-6R-6L-2R-2L-4R-4L.

For your further information the firing diagram of the Pathfinder twin six is given in Fig. 1.

Finding Corresponding Gear Teeth

Editor THE AUTOMOBILE:—Kindly give me the formula for figuring the number of revolutions a gear must be turned to bring corresponding tooth marks together on timing gears set with odd teeth.

2—What causes end play in a crankshaft to develop?

3—What cause can be attributed to the Remy magneto used on Buicks in 1910 and 1912 making the engine fire on only two cylinders? Is it advisable to grind the worn cam down?

Watsonville, Cal.

A. W. A.

—The method of figuring the number of revolutions a gear must turn to bring corresponding tooth marks together on timing gears set with odd teeth is simply to calculate the least common multiple of the numbers of teeth on each wheel. For instance, if one wheel has sixteen teeth and the other has ten teeth the least common multiple would be 80. Then for every eight revolutions of the ten-tooth wheel or five revolutions of the sixteen-tooth wheel the same teeth would come into mesh.

2—End play in the crankshaft is very often due to thrust by the clutch springs. It may also be due to the mis-alignment of the pistons and connecting-rods.

3—It very often happens that a cam will wear in one point only and it is quite evident that you have a case of this kind. Since the shape of the cam determined the synchronism of the magneto and since special machinery is necessary to get the proper face angles on the cam, the cam itself should be replaced with one of the standard Remy cams.

Determining Area of Poppet Valves

Editor THE AUTOMOBILE:—How is the valve area determined in a poppet valve, having the two diameters given; also, the lift.

2—What is the co-efficient of friction used in designing a poppet valve?

3—Of a Knight type valve?

4—How is the inertia of the reciprocating parts of a motor calculated?

5—How is the velocity of the gas in the intake and exhaust pipes determined?

6—Why should counterweights on crankshafts be placed in the same planes that the crank throw is in?

7—What is the critical speed of crankshafts? How is it determined?

8—What is a harmonic vibration?

Frankfort, Ind.

T. S. W.

—By valve area it is presumed you mean the area of actual opening. The area through which the gas passes is the surface of a truncated cone. Referring to Fig. 1, let the sketch represent an ordinary 45 deg. poppet valve. The

truncated cone is that bounded by the edges DA and $D'A'$. The area of the surface is then the quantity desired as the two diameters you mention are DD' and AA' and the lift is DB .

$$AD = BD \cos 45 \text{ deg. or, } AD = .707 BD.$$

The area of the truncated cone will be AD multiplied by the mean diameter or $\frac{DD' + AA'}{2}$ times π . The expression for area then becomes by substituting:

$$\text{Area} = \pi (.707 DD' \times DB + .353 DB^2)$$

If h be the symbol for the valve lift and d the symbol for the clear diameter the expression for area for a 45 deg. valve becomes:

$$A = \pi (.707 dh + .353 h^2)$$

2—The coefficient of friction is only taken into account in an empirical manner.

3—This is also empirical.

4—The inertia is calculated by the ordinary formulae for energy in mechanics.

4—Inertia of any moving part can be calculated by the basic inertia formula for acceleration. In other words, acceleration is the act of overcoming inertia and it is expressed as the change of velocity which takes place in a unit of time. Where F is acceleration, M the mass of a body, V the velocity and T the time, F is equal to MV divided by T . However, in designing the motor it is just taken for granted that the inertia of the reciprocating part will be at a minimum when the weights are at a minimum and hence every effort is made to keep the weights low.

5—The velocity in the manifolds is calculated by dividing the volume of flow by the area of the passage, and the volume is determined by the displacement per unit of time multiplied by a factor which takes into account the volumetric efficiency.

6—This is by no means always the case and depends entirely on the individual system of balance employed.

7—The critical speed of a crankshaft is the point at which vibration due to speed commences. It is determined experimentally.

8—The term harmonic signifies a connection with sound and connected with the word vibration signifies a rate of vibration which is a multiple of the fundamental note. The pitch of the note varies with the period and amplitude of vibration.

Regulation of the Heinze Generator

Editor THE AUTOMOBILE:—Will you give a circuit diagram of the voltage regulator and connections as used in the Heinze generator 1916?

2—Do any other systems other than the Westinghouse, Bosch, Heinze and Bijur use voltage regulators? If so, give names and are they of the vibrating contact type?

3—Are the Leece-Neville and Wagner 1916 systems using third brush regulation? Has Bosch done away with using the pole pieces to draw in the armature and now using a piece of iron on the armature and a separate coil for this

operation and do the Bosch still short the armature on the meshing contact of the starting switch?

4—Why is the positive shunt lead carried all the way to the battery instead of grounded on the Bijur system on 1915 Scripps-Booth?

Newark, N. J.

R. J.

—The circuit diagram of the voltage regulator and connections in the Heinze 1916 generator is shown in Fig. 1. Wire A connects to the generator field, the other end of the generator field being grounded to the frame of the generator. The negative brush is also grounded, this being a single wire system.

Wire B connects to the ground, this being the outer end of the potential winding, the inner end of this same winding connects to the regulator cut-out magnet frame, which is insulated from the grounded frame of the generator.

Wire D is the outer end of the current winding and connects to the positive lead of the storage battery, the inner end of this winding connects to the contact shown on the cutout side.

Wire C from the regulator cutout magnet frame connects through the generator switch to the positive brush of the generator. The generator switch is a part of the main switch on the dash, and is so arranged as to break this circuit when the starting button is depressed.

2—All electrical systems on cars have a means of regulating the voltage. In some this method is inherent with the machine due to the type of winding. In others there are exterior means. At any rate every complete system must have voltage regulation.

3—The Leece-Neville system is regulated by the third brush method, and the Wagner also employs the same system. The Bosch company has not done away with the construction in the flywheel starter, that causes the armature to be drawn into the electrical center through the magnetic influence of pole pieces. The Bosch company does not short the armature when the gears come into mesh but through the use of a shunt table the current in the armature is limited and not shorted.

4—The wiring diagram for the Scripps-Booth is shown in Fig. A for all cars numbered from 1 to 1100. Fig. B shows the wiring diagram for cars numbered above 1100.

Referring to Fig. A the shunt field lead is carried to the positive battery terminal instead of being grounded direct, so that removing the storage battery opens the shunt field circuit of the motor generator, which prevents any damage to this machine in case the gas motor is operated without the battery.

The starting switch shown in Fig. B has three positions, On, Off and Idle, and the field circuit of the motor generator is broken through this switch when the switch is moved to the Idle position, which would be the normal operating position when running the car without the storage battery.

Switches on cars from 1 to 1100 inclusive were not provided with the Idle position, hence the necessity of carrying the shunt field lead back to the positive of the storage battery.

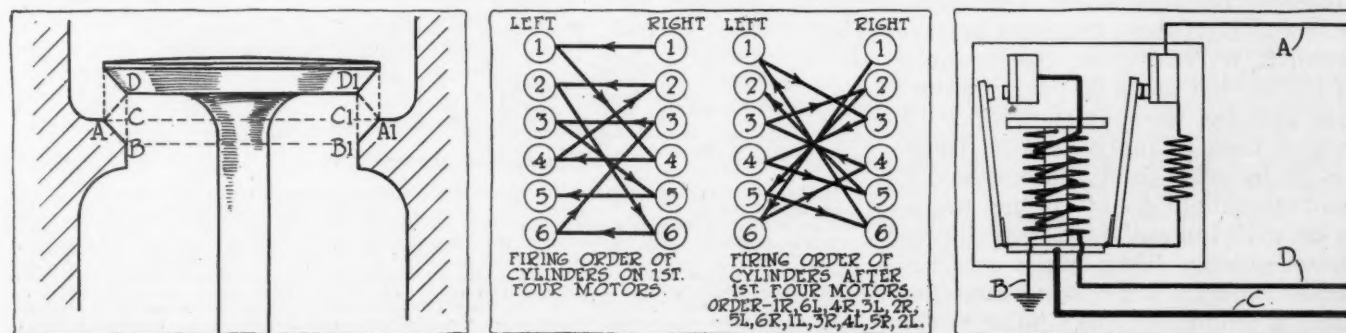


Fig. 1—Left—Diagram referring to method of calculating clear opening of a valve; center, firing order of Pathfinder twelve motors; right, control system used with 1916 Heinze generator

The History of the American Automobile Industry—13

Steam Vehicles in England, 1860 to 1870, Immediately Before the Invention of the Flash Generator in France, which was Responsible for the Great Modern Development in Steam

By David Beecroft

WE now come to the last few years preceding the modern movement for the development of steam vehicles in France, associated with such names as Bollee, Serpollet, and DeDion Bouton, around which clusters the inventions which brought steam into the prominence it obtained in Europe and America until a few years ago. This group was responsible for the flash boiler design which was so extensively used in this country by the White company. Before proceeding with this great development of the flash generator some of the developments in England and Scotland between 1860 and 1870 are of interest as showing the development made in these countries in spite of the handicap of road laws which made operating vehicles on the road practically impossible.

At the exhibition of 1862 were shown automobiles by Yarrow & Hilditch and also by Tangyes of Birmingham. The former had a vertical tubular boiler and a separate engine for each wheel. It would carry thirteen people and weighed 5000 lb. The latter used a very similar engine arrangement. In the same year A. Patterson built a carriage having the boiler and engine both mounted on the front wheels which served for steering and propelling.

A steam super-heater was used on the wagonette of Catley & Ayres of York, built in 1869, and frequently used, carrying four people. It weighed 1500 lb. empty, and could run 20 m.p.h.

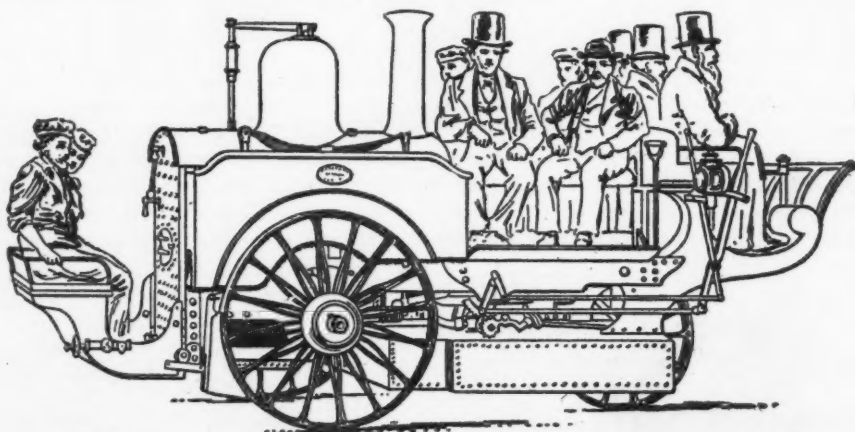
About 1870 several Scotch engineers took up the work and produced vehicles, but the most successful seems to have been the road steamers of R. W. Thompson, the inventor of the air tire some 25 years before. His vehicles were fitted with solid rubber tires as much as 6 in. thick by 12 in. wide, and these splendid road smoothers doubtless had much to do with the satisfaction given by these goods. They were sold in India, America and other places for hauling omnibuses and similar work.

L. J. Todd of Leith, Scotland, built several steam vehicles between 1869

and '72. One of these was a light carriage, having three wheels, and each rear wheel driven by a belt from its engine. Nairn, also of Leith, made a three-cylinder omnibus in 1871, which carried 50 passengers and weighed 10 tons loaded. He seems to have used a rope tire to deaden shocks.

A Scotch Experiment

In 1873 Charles Randolph of Glasgow built a very successful vehicle having the operator's cab at the front, a coach body at the center and mechanism with stoker's compartment at the rear. Its capacity was ten people; its speed about 6 m.p.h., and its weight loaded over 4 tons. He used a vertical coal fed boiler and discharged the exhaust into a silencer from which it passed to the smoke stack and thus no steam could be seen. Elliptic front and coil rear springs were used. Although it worked successfully and the authorities shut their eyes at his violations of the law it proved to be something of a white elephant and after being unable to sell it he turned it over to the South Kensington museum. There were a number of others, but all working along much the same lines and meeting the same obstacles.



One of the interesting steam road vehicles shown at the exhibition of 1862 in England was developed by W. O. Carrett of the firm of Carrett, Marshall & Co., Leeds. This vehicle had an interesting history in that it was run approximately 800 miles at night over the roads of Kent, in order to get some use of the highways in spite of the road laws which prevented the use of motor vehicles on them. It was christened the Fly-by-night and was summoned many times for violations of the locomotives act. It bore a strong resemblance to a fire engine and at night the passengers were dressed as firemen with brass helmets. In this way it was possible to escape much interference, but later it was impossible to use it on the highways and it was finally converted into a slow-moving engine. It was made with three wheels and used a locomotive type boiler adapted to stand 175-lb. pressure per square inch. It incorporated a two-cylinder engine which was geared to the rear axle. The axle had the usual differential gear. The vehicle weighed 12,000 lb.

Light Weight as an Ideal in the Designing of Large Cars

A Sequence of Facts and Reflections on Both Sides of the Question—By M. C. K.

AT one time, about 1901, when European cars were immeasurably superior to American cars in nearly all essentials, the American public and industry were stampeded into a somewhat uncritical adoption of the European type of car but soon took sharp distance from the European methods of producing it. Numerous technical details have come across the water since that day and usually have been found worth studying with a view to modification and adoption in the modified form. The high-speed motor represents the latest large wave of technical reform coming over here with strong European endorsement (practically unanimous up to about 2400 r.p.m. or about 1200 ft. piston speed with a stroke of 6 in.) and it has been accompanied in Europe by a considerable effort for reducing the weight of cars. Arrived to these shores the high-speed motor movement with its accompanying demand for lightness—to help in fuel economy and compensate for the weight of lighting and self-starter equipment—has met great hospitality but has encountered a popular reluctance against the frequency of gear-changes which so far has been found necessary with light motors and which of course is more in evidence the more difficult the road conditions are.

In this situation the various factors are yet to be adjusted to American demands. It is not yet quite settled what the normal speed of motors had better be, whether lightness of cars should be accomplished at all costs, or whether, as a rule, we had better strike a medium in stroke length, piston speed, motor size and car weights. To be again stampeded into a complete imitation of the European development, when it is a fact that the most successful European manufacturers have followed it only in part and with great reserve, and when nearly all the practical conditions in America are different, does not recommend itself as the most sensible proceeding at this advanced stage. One of the factors in question, the light weight of cars, especially invites analysis, because its appeal escapes all criticism in theory and leaves it in doubt only to what extent such lightness may be reconciled with other requirements in practice and to what extent it is likely to be economically valuable in the future. That the lightness should always be as pronounced as all due consideration for other car factors will permit—cost of production, strength, anti-fatigue quality, rigidity where wanted, road ability, durability, efficiency of lubrication, etc.—is so nearly self-evident that lightness may easily become accepted as an ideal for car construction if public opinion accepts it as such without viewing the subject from many other angles than that of the conspicuous and popular advantages. It is the object here to let some of these other related ideas file in review before the reader, to produce, so to say, a perspective and a cross-section of the possibilities for light car construction rather than merely front and plan projections.

Lightness by Reduced Size Came First

For more than ten years past the average car both in Europe and America has been getting heavier, with corresponding increase in tire, oil and gasoline bills. During the same period upkeep expense has gone down, repairs getting much lighter and cheaper with improved construction. But the operating expense—mainly for tires, fuel, oil and garage—became more onerous in the measure as cars were used more and more by the less wealthy. The wages of chauffeurs can here be ignored. The remedy for the economical burden

has been sought and found very generally in small cars, in which the weight is escaped through reduction of the size. The much lower first cost pointed the way in this direction unmistakably. In some of these small cars the driving speed was also reduced, but in the most successful case on record, the Ford car, the weight reduction due to small dimensions was very much accentuated by using a new grade of steel throughout, while the driving speed and its indirect cost were practically left at the car owner's discretion. It was low-priced and cheap to run long before methods for its production were developed which increased the profits to the makers, and it is still a good example of lightness due to design as well as to small size. In general the small car, spite of diminished luxury, was found suitable—first here and subsequently in Europe—for many people's daily use of a vehicle. Still, the large car remains a necessity for as many others, and it remains heavy; heavier in 1915 than in 1905—costlier to operate though cheaper to keep in condition for operation. Only a few manufacturers of the larger cars have from the beginning aimed constantly at reducing the operating cost by minimizing the weight, and the very general adoption of alloy steels for parts subject to wear or special stress has had only a feeble tendency to prevent the gradual and apparently unavoidable increase of total weight from becoming excessive.

"Life" Largely a Carbureter Question

Now, under the pressure of the demand for economy and efficiency, the difficult problem of making large cars light is rather suddenly coming to the front. As said, it has come in conjunction with a demand for light, high-speed motors. The need of producing a car which can be accelerated promptly by the throttle alone, although the motor has small cylinder volume, may have had as much to do with the desire for reducing the weight of the whole car as the view to operating economy. It would scarcely do to let small cars with relatively sluggish motors have an advantage in acceleration over their larger and more pretentious sisters, since prompt acceleration or "life" is one of the luxuries on the road which is appreciated as much in a motor as in a horse by the American public. On the other hand, to accept in advance the conclusion that reduction of vehicle weight represents the simplest and best method for getting prompt acceleration for a car equipped with a light motor is not convincingly clever so long as little effort has been made to find out if a similar result could not be attained by simpler means, such as, for example, by an auxiliary carbureter action.

Among the carbureters found most suitable for high motor speed it is hard to think of any that does not necessarily, by its principle of design, make acceleration more gradual than the exacting car driver would like it to be. He is more interested in what the car will do in the first second after the throttle has been opened than in any ability to accelerate from 10 to 40 miles per hour in 16 seconds, which is about the best that can be done with a car of average weight for its power and a carbureter action depending mainly upon an increased volumetric efficiency at the opening of the throttle for gradually producing the higher motor speed with the stronger suction at the nozzles which in turn will speed the fuel feed and the motor progressively. This system of acceleration—falling far short of steam throttle promptness—is too indirect for a heavy car, although it is sufficient for one that is

light and strongly powered. It is slightly assisted in practice by opening wide first and moderating a few seconds later, but this can only be done with high-class gasoline, so long as the cooling-system fails to keep motors at a uniform temperature at all speeds. For the moment the possibilities for an improvement at this point which might eliminate the need of weight reduction for the mere purpose of facilitating acceleration may be conceived in the form of an injector attached to the carbureter conduit and operating automatically, for a second or two, with small stores of compressed air and gasoline, whenever the throttle is being opened, the extra injection compensating for the anomaly that, with ordinary carbureter action, the relatively weak suction of the lower motor speed necessarily causes the first explosions after the turning of the throttle valve to be weaker than the subsequent ones. Without pretending to say that the suggested boosting device, or one of equivalent effect, is advisable, one can safely infer from its possibility and from its simplicity in comparison with weight reduction that the popular demand for prompt acceleration does not in itself constitute a compelling reason for undertaking a radical reduction of the total weight of the vehicle, so long as simpler means to the same end are not adopted.

The active reason for undertaking such a weight-reducing campaign must therefore be the economical one of reducing operating expenses. The better acceleration of the lighter car can only be an incidental advantage, and this is perhaps also the usual view. The main facts are admitted; namely, that a desire has become general among American manufacturers for reducing the weight of cars, while holding the size of motors down, and that the economy in tire, fuel and oil expenses gained by such weight reduction has been abundantly proved. *THE AUTOMOBILE* said editorially in the issue of Dec. 23: "Light weight is the greatest factor in reducing the upkeep and so is of immense importance to the owner." Before long, since ideas travel fast when plainly containing a large element of truth, this view may become accepted as an axiom and may be taken to cover the whole field of constructive varieties of automobiles. And, on the other hand, the majority of engineers and manufacturers will probably not see their way clear to any considerable reduction of the weight of their cars and will be able to present excellent reasons for not allowing construction to be dominated by the consideration of minimum operating cost.

Broader Paths to Economy

At first glance one would be inclined to say that, if the object of light weight is economy, it should be materialized economically and without increase in the first cost of production, but it is of course a simple financial question of capital and interest which is here involved. The saving in upkeep due to light weight may be large enough to justify a higher first cost, and the incidental advantages of quick responsiveness to the throttle, to gear change and to the touch of the pilot's hand on the steering wheel—as well as a probability for less bother with tire troubles—may be sufficient to place the light-weight large car in a class by itself, a class where high price and high merit go together until the light-weight design and construction become standardized, or at least fully established to the satisfaction of the manufacturer and his customers, whereafter the price may become normal while all the special merit remains, unless the rest of the industry meanwhile has learned to produce equal merits by other means. **IT IS CONCEIVABLE THAT CARS MAY BE CONSTRUCTED WHICH ARE NECESSARILY HEAVIER THAN THE LIGHT-WEIGHT IDEAL BUT POSSESS ALL ITS ADVANTAGES ON THE ROAD AND IN ECONOMY OF UPKEEP WHILE POSSIBLY BEING ALSO MORE CHEAPLY PRODUCED OR LESS SUBJECT TO FLAWS DUE TO ERRORS IN THE APPLICATION OF THE PRODUCTIVE METHODS.** With regard to the

last point, all remember, for example, the time when a large percentage of cars from certain factories went wrong through the failure of light component parts which had not been properly heat-treated or were made of unsuitable steel or were too closely designed and succumbed to fatigue or lack of rigidity. Most steel troubles are over—mainly because conservatism and specialization are in command of the metallurgical departments of automobile and parts factories—but light-weight design still requires the tip-top of ability and experience if it shall afford the same guarantees for the avoidance of troubles which have been worked out with standard types of construction through the collective efforts and experience of the industry.

In order to keep very sharply in mind where a complete acceptance of the ideal of light-weight construction for large cars leads to, it is necessary to compare with other means at disposal for accomplishing the same or a similar degree of upkeep economy and "road ability" and to face the fact that such other means may be widely applicable to all sorts of motor vehicles, while nearly all the advantages of light-weight construction of a vehicle disappear if the vehicle is required to carry heavy loads.

Operating Cost and Total Upkeep Expense

A distinction between operating cost and upkeep cost is among the first ideas suggesting themselves when the subject is analyzed. As a rule the term "upkeep cost" is used to cover the whole expense of keeping and using an automobile, once it is paid for. But, while it is proved sufficiently that the light car can be driven more cheaply than the heavy one—so long as the question is of two cars of about equal grade and both weighing more than about 1500 lbs.—and can be kept tire-shod more cheaply, it is not nearly so well proved that it can also in other respects be kept in commission more cheaply, general durability and repairs being in doubt. The actual weight of the average car, being the result of an evolution and a process of survival, in which the pros and cons relating to dimensions, materials and shapes have come up for consideration many a time, argues in the opposite sense. Indeed, the new art of building light cars, in the sizes which so far have been heavy, consists perhaps mainly in applying very close reasoning and experimentation to the finding of new constructive expedients which will permit the weight reduction without endangering durability and increasing the upkeep expense. In other words, the acknowledged risk in undertaking to lighten construction is that the upkeep expense depending upon liability to trouble and repairs may be increased more than the operating expense is reduced. The ideas advanced by Mr. Brush on frame and running-board design, the details of the new Marmon car, the Chandler, the Fergus car, the broader adoption of aluminum alloys, compared, for example, with the means employed for a number of years to make the Franklin cars lighter than other cars of equal size and power, can scarcely fail to convey the belief that it is no easy matter to reduce weight without increasing maintenance expense, unless some of the standard organs of the average automobile are omitted (all the water-cooling organs in the Franklin) and chrome-steel and aluminum are used throughout in closely studied shapes.

While there is no doubt that weights can be reduced **SOMEWHAT** without great or lasting increase in the cost of production and with economical benefit with regard to the entire upkeep and operating expense, it seems equally certain that **RADICAL** light-weight construction must for the present remain a difficult specialty, with the economical advantages depending strictly upon the individual engineering ability devoted to it and the production facilities behind it. Radical light-weight construction is new construction and cannot be inaugurated to-day and materialized next summer without exposing both maker and buyer to risks.

Any argument based upon the pounding to which a car is subject on the road (with the severity supposedly in proportion to its weight) applies without fail to the wear and tear and sizes of tires, but loses in force when applied to the mechanical construction, just because tires and springs temper the shocks and usually temper them most effectively in heavy cars. A better point for the light-weight construction relates to the lubrication. If bearing areas are not reduced with the weight, the specific pressures are reduced and the lubricating oil gets a better chance to perform its saving function, being neither squeezed out or heated unduly. That bearing areas should not be reduced in light-weight large cars, to correspond with the normal reduction of pressures, follows from the experience alone that every car, and especially every large car, is liable to be overloaded to its full volume-capacity occasionally.

Light Car Results by Other Means

Assuming, in accordance with the foregoing, that the principal inducement for undertaking radical light-weight construction lies in the economy and responsiveness in the operation of the car to be accomplished by it (while the upkeep economy as a whole must remain in doubt until proved in each case), the manufacturer may contemplate other means for attaining the same advantages, while combining them with the safety of conservative design and with a wider application of the type of chassis produced. If he placed a limousine body on a light-weight chassis, he would not have much left of operating economy and responsiveness based on light weight. He prefers to gain economy also for those cars in his output which are to be heavily equipped. Suppose that he aims to cut down the weight of the open touring car conservatively—say 10 per cent for the chassis and all he possibly can for the body—doing this by improved design and not by paring down dimensions and also reducing the factor of safety. He can then choose a motor of slightly larger cylinder volume than would be needed for a car of still lighter weight, and can from this larger motor get the desired responsiveness of the car, but the fuel and oil consumption will be a little higher. A special study in carbureters, as referred to above (and giving such results as are said to have been accomplished by one of the prominent Detroit companies) will place his car on an equality with the very light construction, so far as responsiveness is concerned. The fuel consumption may or may not be larger, depending upon his degree of success with the carbureter, similarly as light-weight success depends on an unfailing ability to provide against slips in design, materials and workmanship. At worst he has an economical margin against him for fuel, oil and tires, while being even on acceleration and ahead on safety against repair bills and usefulness of his chassis for several kinds of body and load. The margin against him he can make up in any manner that will produce a corresponding saving in operating cost. He can save lubricant on the plan so capably organized in the Fergus car. Outside of the cylinders more oil is ordinarily wasted than is used. By arranging to oil every six months only, the waste is stopped, damage from failing to lubricate is stopped and work is reduced—all items of economical value. He can design his slightly larger motor with a slightly larger cylinder bore than that used for the motor in the radically light-weight car, thereby also gaining connecting-rod and crankshaft bearing area, and his consumption of cylinder oil will then compare favorably with that of the smaller motor pulling the smaller weight. The whole motor economy here involved can of course not be expressed in a few words, but it is quite well established that oil economy is not the forte of the ultra-light motor, and a shade of conservatism is in the matter of this item a source of operating economy. The use of eight-cylinder or twelve-cylinder motors of relatively short stroke and comparatively small specific pressures for a given power

may also be worth investigating with a view to fuel, oil and tire economy. Neither is the Knight motor out of question.

Paring Down Over-All Dimensions

Comparisons must of course always have reference to cars of substantially the same size; giving the same degree of comfort for the same maximum number of occupants, the same degree of style. Economy gained by stinting any of these factors and in reality producing a medium-sized car which will serve the same purposes as are served by a large car, only not quite so generously, does not count in these reflections, though it may count for making sales and demonstrations. But if a general reduction of carriage dimensions is actually so managed that the comfort and style features remain unimpaired while the weight is reduced approximately in proportion to the dimensions, and tire economy is correspondingly increased, so as to equal that of the radically light construction, the means that may be adopted to that effect are properly to be seriously considered, as against the option of shouldering the problems of radical light-weight construction. All are not infatuated with large over-all dimensions, and it is proper to cater to variations in taste and to throw economical inducements into the bargain when possible. For example, if the backs of seats can be made thinner by new methods while the seating remains equally luxurious in all respects and ample, and by this means, in conjunction with a short type of motor, the whole frame length may be shortened 8 in., with the load better centered and suspended, the general reduction in weight due to the shortening is entitled to be considered on equal terms with a weight reduction accomplished without reducing the carriage dimensions. Some possibilities of this nature were exhibited at the recent show in New York, and while only time can fully demonstrate their worth they confirm the belief that studies in weight reduction, from a conservative standpoint, can be commenced in the carriage work with smaller risk and greater reward than in the chassis and running-gear—the motor remaining always a separate consideration. The advantage of the V-type for keeping the total weight down, where the luxury of more than four cylinders is wanted, may for cheaper cars even lead back to the four-cylinder upright placed crosswise which never was discarded for final reasons. With piston displacements constantly decreasing and thoroughly automatic production, even the use of two small four-cylinder motors crosswise may not be out of question for load-carrying vehicles, serving for fuel economy if one of them is always held in reserve for hard pulls. These remoter chances give a certain breadth to the question of means for effecting operating economy coupled with responsiveness.

Many Roads to Final Results

The order in which improvements are undertaken is after all the main issue in which there can be any divergence of opinion, since all must aim for final perfection and the case where one concern by one year's work accomplishes everything that can be done for such a comprehensive set of purposes as here in question, has never yet been better than imaginary.

Competing for Tire Economy

Reverting to the main line of thought, which deals solely with existing types of cars, the question now comes up: Having a car in which weights are somewhat but not radically reduced and in which the motor, the carbureter, the bearing areas and the lubricating system have been studied energetically with a view single to equalling the responsiveness and the fuel and oil economy of a still lighter car of comparable size, what can be done to equal or surpass this new competitor in tire economy?

It may be assumed that the ultra-light car itself is built with considerable thought in this direction, though it mainly

relies on light weight. It probably has wire-wheels, a rather low unsprung weight, a long wheelbase, a fairly well-centered load (without which the long wheelbase is useless for tire economy), springs of up-to-date material and design, with dampers attached.

To get full benefit of light weight it must however be equipped with tires whose fabric is so flexible as to absorb inequalities and thereby reduce the bouncing which the relatively light weight accentuates, and which cannot ordinarily be avoided economically by lower inflation. There is a choice between larger tires (which give increased flexibility) and cord tires (which also admit of lower inflation) for the radically light car, and in either case the question of the tire economy actually accomplished is one yet to be decided by tests. It is also to be viewed in connection with the question of comfort and of liability to tire injury. Just at what point on the scale of vehicle weights tire economy can be made to come unalloyed with drawbacks is not very well known, but on the whole and at equal speeds minimum weights make for economy and maximum actual weights make for comfort. The same degree of more than average ability which can give light-weight cars a comfortable tire action can probably give cars weighing 20 per cent more an economical tire action. Such an ability can aim to surpass all in tire economy with as good a chance of succeeding as the radical light-weight constructor has for surpassing standard construction in lightness without slipping into drawbacks of the kind that appear later or sporadically in a year's output.

Means Not Yet Exploited

Brakes and spring suspension afford a field in which to dig, probably the most promising one. Chains show a clear superiority in tire economy over shaft drive, partly owing to the smaller unsprung weight going with chain drive, but they have practically been ruled out for lack of a really good chain casing and for cluttering the space between wheel and carriage body. Other features have been ousted once, however, and have returned successfully under new conditions, and chains may again become standard for large cars of one price class or another; for example in connection with worm drive to the countershaft and remodeled brakes and springs. The worm would permit dispensing with a gear reduction between the sprockets, and parallel chains would make a chain casing simpler and sightlier, adjustments more satisfactory (as the two sprockets would wear alike). For the present, however, other changes are more in line with the trends in manufacture.

Smooth Gear Changes

In gear ratios there is a fully acknowledged study subject bearing more directly on tire wear than usually suspected, the ideal being that a change of gear shall cause no change in vehicle speed and therefore no sudden changes in wheelrim pull. *THE AUTOMOBILE* of Sept. 3, 1914, pages 450-452, and Oct. 1, 1914, pages 630-632, had articles on this subject adapted from the German originals by F. Achilles, and other material is available in French, German and English.

Brakes Worst Present Offenders

Brakes retard more rapidly and suddenly than carbureters, gear-changes or clutches can accelerate and must therefore in practice cause more strains and wear of tires than any which may be due to unsuitable gearing. Unlike clutches which have been developed and become gentle, brakes are still harsh when used harshly. In their improvement alone there may be more tire economy than in a 20 per cent weight reduction. Eventually, it would seem, rubber tires should not bear the brunt of any emergency brake service, as they now do. Drags are an alternative so far too rashly rejected.

In spring suspensions, which temper the direct knocks and glancing blows that it is the business of tires to receive from all directions, it must of course be the object to establish as wide a range of suitable spring action as variations in speed, load and roads necessitate, and a glance around among the many efforts now being made for the bettering of spring action leaves it beyond serious doubt that the best and final spring suspension system is still at large. When recognized and developed, it may be enlisted in the competition for effecting operating and upkeep economy through special construction. Meanwhile, in the gradual improvement which is going on, there must be room for special efforts to surpass the average results, not only in the vehicle springs but in the cushioning of stresses throughout the car.

Extreme Light-Weight Always a Specialty

The means indicated—comprising better brakes, most suitable gear ratios, improved spring suspension and perhaps a modified chain drive for certain classes of vehicles—should suffice for relieving the search for upkeep economy of strain and excess in any one direction, while having the advantage of being widely applicable to all kinds of vehicles, in contrast to extreme light-weight construction which must be designed afresh for each model.

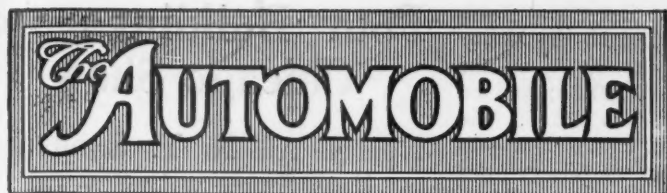
Means for Reducing the Glare of Lamps

WHEN regulations are contemplated by which the glare of automobile headlights may be reduced, one of the principal considerations is to avoid working a hardship upon the hundreds of thousands of motorists who are already the possessors of a complete lighting equipment. The measures recommended are therefore made as consistent with such normal equipments as possible and may consist only in prescribing that the headlights shall be mounted at such an angle and height that the center of the light cone is not above waist height at a certain distance, say 100 ft., in front of the car.

The subject can also be approached more radically and with a view to regulating the kind of lamps to be placed in the market in the future. Then it becomes important to know what is the cause of glare. A French lamp designer has answered this question in one word: Contrast. He maintains that a spot of strong light causes glare by contrasting so strongly with everything around it that the human eye cannot accommodate itself to both effects at the same time, and that the same amount of light extended to a line illuminates equally well, when correctly managed, while not troubling the optical nerves. He has designed a headlight board, as long as the car is broad, in which are set a dozen incandescent lamps, each with its reflector, and he mounts this board in a pair of pivoted arms by means of which it can be placed in three positions of different height above the ground. As the illumination received by the roadway is greatly increased if the light rays strike it at a large angle, he thus claims to accomplish at the same time a stronger illumination—with shortened shadows—and the elimination of all objectionable glare.

One Coat of Paint Better than Four

EXPERIMENTS conducted for the Royal Society of Arts in England have shown that each fresh coat of paint put on top of another on an iron plate increases the amount of rust which forms on the plate. Four plates painted with one, two, three and four coats were exposed to steam for one day, the paint was dissolved off and the results mentioned were observed. The explanation given is that each subsequent coat tends to dissolve a part of the previous one and renders it more porous. Air and moisture penetrate to the iron by way of the pores.



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Watch-Like Accessories

RIVALING the watch in delicacy and accuracy of manufacture some of the accessories which are now placed on cars as standard equipment are monuments of painstaking care. The improvements which have been made this year in speedometers, horns and other equipment are as important as the improvements in the design of the car itself. The close limits of workmanship accompanied by lowering of prices due to the solution of problems of production have rendered accessories as a whole better although lower in price than ever before.

We have not come to the end of the movement toward better accessories, however, and the tendency toward better materials and finer workmanship must be carried on in answer to the demands of the general public for the best there is to be had in equipment. It is true to such a large extent that the equipment sells the car, that the manufacturer of automobiles cannot afford to neglect the quality of what he puts on his car. The consequence of this is that the manufacturer of an accessory, if he wishes to bid for a contract for standard equipment on a stock car, must show something beyond mere low price before his product will be considered.

In speedometers, for instance, the public has grown accustomed to the use of the road route book. In following these it is necessary to have the mile-

age on the speedometer and the mileage on the route book check exactly. To keep a constant check it is necessary to have a convenient form of trip mileage reset. The result is that the speedometer manufacturers have heeded the demand of the public and the speedometers for 1916 are equipped with convenient wheel resets. They are also more accurate and in certain instances actual watch parts have been incorporated in their construction to give the delicate accuracy so much appreciated by motorists, as a whole, who use the speedometer constantly.

The principle is the same throughout the entire range of accessories. Better windshields, better horns, better lamps and so on are found throughout the entire gamut of equipment on the 1916 cars.

Body Art and Science

THE modern automobile body can be regarded from three viewpoints. Firstly, it is a set of seats or chairs, and as such has to be designed much as any other similar accommodation. Secondly, it is an engineering structure to carry the seats with the least weight and the greatest rigidity possible; and, thirdly, it is a form or shape which must please the eye when combined with the chassis. Furniture maker, engineer and practical artist are all needed to produce the desired result.

Examining the bodies of to-day it is easy to see that in many the three requirements have been met with considerable success. In many, though, it is equally obvious that the artist has overruled the engineer, or both have given the furniture designer much too little scope; so in saying that the automobile body of 1916 is much better on the average than it has ever been before, it is not to be assumed that finality has by any means been reached.

There are still only a few bodies which are perfectly comfortable. There are equally few that are quite as light and strong as they might be, and it is easy to criticize the appearance of many others. Interest in body designing and in body engineering is quite recent; it is only within a few years that the subject has received the attention it deserves, so it is reasonable to expect extended development during the next several years. The progress made since January, 1914, is remarkable, and if the pace is maintained another couple of years may easily see something like a final type evolved.

The Chicago Show

IT seems likely that this year the Chicago show will differ less than usual from the show just concluded at New York, so far as concerns the exhibits. In 1915 the manufacturers announced their new models early, and we have had nothing to correspond to the rush of eights which occurred in January of last year.

At the 1915 Chicago show were a good many new cars which could not be got ready in time for New York and were sprung as surprises, though anticipated by the inner circle. This year there are scarcely any forethoughts of this nature.

New Company Will Make Medium Price Car

Jordon, Zens and Begg Leave Jeffery—To Start Manufacture Shortly

KENOSHA, WIS., Jan. 15—E. S. Jordan, secretary and general sales manager of the Thos. B. Jeffery Co. has resigned that position to become the head of a new concern to manufacture a new car.

With Mr. Jordan is Paul Zens, purchasing agent of the Jeffery company, who has been with that concern for thirteen years, rising from the position of office boy. R. S. Begg, experimental engineer of the Jeffery company and formerly acting in a similar capacity with the Packard and Hudson plants is also with Jordan.

Although no announcement is made as to the details of the car or the location of Jordan's factory, it is understood that Zens already has bought material and parts for the initial unitive production of 2000 cars. In broadening his field of endeavor Mr. Jordan carries with him the best wishes of the Jeffery company.

It is understood that the car will be assembled from first quality parts, and that special pains will be taken with the body design.

Fritchle Preparing Gas-Electric Model

DENVER, COL., Jan. 15—The Fritchle Automobile & Battery Co., this city, is bringing out a gas-electric car to be operated the same as its electric model with one electric unit and a four-cylinder air-cooled motor. There will be no change gear mechanism or a clutch, the electric battery power being consumed only on low speeds and heavy pulls through mud and up hill, the engine cutting in automatically. The battery is charged automatically at speeds between 12 and 20 m.p.h. Higher speeds are obtained by using both the engine and battery at the same time.

General Rise in Tire Prices

NEW YORK CITY, Jan. 19—Republic tire prices went up 5 to 10 per cent today, thus supplementing the general rise which was started Monday when the United States Tire Co. advanced its prices 10 per cent on all grades of its tires. Yesterday, Goodrich, Goodyear, and Firestone announced increases. Goodrich tires are now selling 10 per cent higher on the usual sizes of both cord and fabric types, no changes as yet having been made on the unusual or less popular sizes. Goodyear also increased its prices 10 per cent on both its cord and fabric types; and Firestone an-

nounces a 10 per cent increase. Goodrich has raised its prices on the 28 by 3-in. tires from \$8.50 to \$9.35; on the 34 by 4 from \$19.40 to \$21.34; and on the 36 by 4, from \$20.50 to \$22.55. The Goodyear 32 by 3½-in. size is now selling at \$14.70 as against the former price of \$13.35; the 34 by 4 is now \$21.35, compared with \$19.40; and the 36 by 4½ quotes at \$30.10, compared with \$27.35.

A number of the tire companies have not as yet announced any changes but expect to. The Hardman company expects to go up 10 to 20 per cent in the near future and is at present taking few orders at the prevailing prices. The Ajax company expects to raise its prices the last of the week, and Diamond tire prices, it is stated, are slated to go up.

These rises now include ten since Jan. 6, when Kelly-Springfield started the increase with a 7½ to 26 per cent jump. As announced in THE AUTOMOBILE last week, Empire list prices went up 15 per cent; Falls rose 10 per cent, and Globe and Pennsylvania went up approximately 25 and 20 per cent each.

Some of the new prices on United States Tire, Goodyear and Goodrich are as follows:

Goodrich Tires			
Size	Old	New	
28 by 3.....	\$8.50	\$9.35	
34 by 4.....	19.40	21.34	
36 by 4.....	20.50	22.55	
U. S. Tires			
Size	Old	New	
32 by 3½.....	\$13.35	\$14.70	
34 by 4.....	19.40	21.35	
36 by 4½.....	27.35	30.10	

Coghlan a Klaxon Director

NEWARK, N. J., Jan. 18—At the annual stockholders' meeting, W. P. Coghlan was elected a director; and at the directors' meeting was made secretary of this company. He will continue as general sales manager.

Blood Bros. Elects New Directors

GRAND RAPIDS, MICH., Jan. 14—At the annual election of the Blood Brothers Machine Co., Allegan, Mich., manufacturer of the Cornelian car, the following directors were elected: F. I. Chichester, L. H. Mattingly of Kalamazoo, Judge O. S. Cross, C. C. Blood and Mr. Potter.

Couple-Gear Directorate Chosen

GRAND RAPIDS, MICH., Jan. 14—The following directors have been chosen for the Couple-Gear Co., Grand Rapids, Mich.: George Hummer, W. C. Hopson, A. J. Brown, F. E. Brown, Alexander Dodds, Clayton Church, W. B. Church, M. S. Hopkins, A. B. Knowlson. According to reports of officers the company has just completed a successful year. Most of its product is disposed of in Boston and New York.

Four Buildings for Chicago Show

Nearly All N. Y. Exhibitors Have Space with Several Others Added

CHICAGO, ILL., Jan. 19—Chicago will be host to the 1916 models, the newest accessories and legions of motor car connoisseurs and dealers Saturday and the week following when the sixteenth annual motor show, held under the auspices of the National Automobile Chamber of Commerce and the management of Samuel A. Miles, will be staged in this city. So large is the impending display of cars that four buildings will be required to house them—the Coliseum, the Coliseum Annex, the First Regiment Armory and the Greer Building.

As at previous shows, the cars will be shown on the main floors of the Coliseum, Coliseum Annex and the First Regiment Armory, with the overflow in the Greer Building, while the accessories will be displayed in the basement and the gallery of the Coliseum and the balcony of the armory and Coliseum annex.

New York Exhibitors Represented

With only one or two exceptions, all the car makers exhibiting at New York will play a return engagement here. The most notable absentee will be the Fergus, the stripped chassis from the land of the Shamrock which attracted so much attention at New York because of ease of maintenance and simplicity of lubrication. Several companies, however, that did not show at New York will have models here, including the Farmac, Elgin, Monitor, Elcar, Halliday, Champion, Crow-Elkhart and Chicago Electric.

More than 200 manufacturers of parts and accessories have reserved space and this insures a display of fitments equal to that of past exhibitions.

Japanese Decorations

When the doors of the four exhibition buildings open at 2 o'clock Saturday afternoon, four gardens of old Japan will be revealed as decorations symbolic of the Mikado's realm have been selected for the 1916 show and the decorative scheme will be carried out in each of the buildings. The work of transforming the bare structures into places of beauty was started last week and the decorators will be through by Thursday when the cars, which now are sidetracked in local freight yards, will be put in place.

Nothing, from the artistic viewpoint, has approached in beauty the decorative scheme which prevails in each building. Four parks of quaint Tokio have been reproduced by artist Tietzel at a cost of

approximately \$50,000. Monumental gates, towers and pagodas have been erected. The walls are screened with the foliage of cherry trees. Ninety thousand square feet of canvas have been used to obtain a blue sky effect. In fact, the Chicago show will have a Nipponese atmosphere that might seem to be more suited for the display of jinrickishas than the exhibition of motor cars.

As Chicago is the center of a great distributing territory, the local show will be the mecca of dealers from all points of the compass for a radius of 200 miles and luncheons and dinners, at which the men who deal directly with the ultimate consumer will be guests, will feature the week. Wednesday will be Society day and also the occasion of the annual meeting of the National Automobile Chamber of Commerce.

Dealers from Texas

A feature of the week will be the visit of a delegation of 150 Texas dealers who are scheduled to arrive Monday morning on special trains from Fort Worth and El Paso. The Overland representatives in the Northwest will give the Chicago show the double O on opening day before going to Toledo to inspect the Willys-Overland plant.

An appeal will be made to the patriotism of the motorists of the Middle West during the week of the show by the Chicago Automobile Club, which will maintain a recruiting office in the Coliseum where owners of cars may enlist in the motor car reserve corps and thereby take an active part in the preparedness campaign for national defense.

Jeffery Has New Sales Force

KENOSHA, WIS., Jan. 17—E. S. Jordan, who for nearly eight years has been in entire charge of sales for the Thomas B. Jeffery Co., having resigned, the sale of Jeffery pleasure cars hereafter will be in charge of E. G. Howard, as sales manager, and W. B. Riley as assistant sales manager; the truck sales department will be in charge of H. C. Hart and the foreign sales department will be in charge of J. A. Rose. All of these men have been connected with the Jeffery company for a number of years.

Premier Board Elected

JOLIET, ILL., Jan. 18—Stockholders of the new Premier Automobile Co., Indianapolis, Ind., mostly composed of capitalists of Joliet, held their organization meeting this week, directors being chosen as follows: H. L. Thompson, C. F. Jensen, E. W. Steinhart, J. C. Flowers, Theodore Gerlach, F. W. Woodruff, and G. E. Woodruff. The directors then elected these officers: President, J. C. Flowers; vice-president, E. W. Steinhart; secretary, C. F. Jensen; treasurer, H. L. Thompson.

Many Trucks in Detroit Show

Fewer Electrics and a Good Range of Gasoline Cars

DETROIT, MICH., Jan. 15—Although there were twenty less cars on a floor of the three buildings used this year at the fifteenth annual automobile show promoted by the Detroit Automobile Dealers' Association, it was held by the first nighters and by exhibitors to be the best one as yet seen in the automobile metropolis of the world.

It is a more interesting show than its predecessors, as practically all the novelties in construction that were shown in New York are also to be found here. It is, as an Easterner said, a miniature New York show with an excellent commercial vehicle section in addition. Perhaps one most regretted absentee is the new Marmon car, but its local distributor is showing the car in the lobby of the Hotel Statler, not having been able to secure the desired space.

No Newcomers

A feature this year is practically the entire absence of entirely new cars. In the passenger car line there is no newcomer. There are, however, quite a few cars which had never previously been seen in this city. In the commercial car line there is a new truck, the Lincoln. Several other trucks unknown to Detroit heretofore, but well known in the country otherwise, are shown. Among the accessories and parts exhibitors there are several who either are new in the business and thus show their wares for the first time, as for instance the Detroit Auto Products Co., Dr. Schorr's suspension, and the Meyer Motor Co.

Cars and chassis on the floor totaled 183 as compared with 203 last year. There are 115 gasoline passenger cars and sixteen chassis; thirty gasoline commercial vehicles and twelve such chassis, and ten electric passenger cars. It is the latter class which shows shrinkage in number, although not in quality, as last year there were twenty-five electrics at the show.

New Lincoln Truck

The Lincoln Motor Truck Co. has its new $\frac{3}{4}$ -ton truck on display. With express body and the usual accessories, it sells at \$985. The chassis only is listed at \$925. Electric starting and lighting system will be furnished at an addition of \$100. The wheelbase of the truck is 122 in. The maximum body length is 10 ft. The motor is a four-cylinder Beaver, 3 $\frac{3}{4}$ by 5 in.; the carbureter a Strom-

berg, the axles Salsbury, the transmission Covert, the steering gear Ross, the ignition system Bosch, and the tires Firestone pneumatic, 33 by 4 $\frac{1}{2}$. The radiator is of the cast tank type, vertical tubes. The springs are semi-elliptic, 36 by 2 $\frac{1}{4}$ in front and 56 by 3 in. rear.

The truck was designed by an English engineer, W. L. Bodman. Those interested in this new company are: J. A. Moritz and L. F. Mullin, members of the firm of Moritz-Mullin Co., distributor of the Signal trucks, and J. E. Hannon.

Equipment for Fords

The Detroit Auto Products Co. shows its roadster de luxe body and equipment for the Ford for the first time. This complete equipment consists, in addition to the special body, of a one man top with boot and side curtains, ventilating windshield, radiator, hood, crown fenders, lamp bracket extensions, tire holder brackets, splash plates, dust shields, foot accelerator, starting crank and running board hangers. A Ford roadster thus equipped weighs 1540 lb. The standard color is Brewster green. The body is 45 in. wide at the seat, back of dash to front of cushion, 30 in.; cushion, 18 in. deep, 10 in. high at front and 7 in. high at back. The price of this equipment is \$197.50 f.o.b. Detroit. A closed top to convert the roadster into a coupé will also be brought out by the company.

Beyerline to Organize New Mfg. Co.

DETROIT, MICH., Jan. 17—J. G. Beyerline and W. L. Daly, who were respectively president and general manager, and general sales and advertising manager of the King Motor Car Co. are among those principally interested in a new automobile company which will make a six-cylinder car to sell at \$900. Both the manufacturing and selling organizations of the new concern are now being perfected and a complete detailed announcement will be made shortly.

Motor Body Co. Building New Plant

DETROIT, MICH., Jan. 17—A new plant is now in course of construction for the Motor Truck Body Co. at Central Avenue and the M. C. R. R. It will be a one-story structure, 64 by 245 ft. There is in addition 2 $\frac{1}{2}$ acres of ground which may be utilized for further expansion. The company manufactures special truck bodies. E. G. Proctor is president and E. G. Thurber is secretary and treasurer of the company.

DETROIT, MICH., Jan. 17—The Liberty Motor Car Co. capitalized at \$400,000 has been formed here. The incorporators are George B. Allen, J. B. Clark and F. W. Henning.

41,000 See Milwaukee Show

Business Transactions Largest Ever Held—Wis. Dealers Hold Banquet for 600

MILWAUKEE, WIS., Jan. 17—Approximately 41,000 people passed through the gates of the eighth annual show of the Milwaukee Automobile Dealers, Inc., held in the Auditorium from Jan. 7 to 13, inclusive.

Exhibitors declare that more actual business was transacted at this show than at any previous Milwaukee exposition. While the volume of business is less, due to the general drop in average price of cars for 1916, more cars were sold and the purchases of detachable winter tops have never been equaled. The number of Wisconsin dealers who actually registered at the show is 15 per cent larger than for 1915, indicating that wholesale business increased in a similar proportion.

From a financial standpoint the 1916 show was the best of the eight expositions which Milwaukee dealers have put on.

The weather ran riot during the seven days of the show. Friday, opening night, was accompanied by mist and a temperature of 23 deg. above zero. On the following Wednesday morning the thermometer showed 20 deg. below zero, the coldest Milwaukee has experienced in ten years. In the interim there was rain, snow, fog and mist. No more unfavorable weather has ever been known during a Milwaukee show. On only a few days was it possible for exhibitors to make outdoor demonstrations with the least degree of comfort at all.

Prosperity talk was rife, both among the banqueters and the speakers. Wisconsin registered 79,791 cars in 1915, a gain of nearly 27,000 cars for the year, and predictions were freely made that 30,000 cars will be absorbed by the Badger State in 1916, making a total of nearly 110,000. It was pointed out that motor car business varies with the size of the annual crop, and bumper crops in 1915 mean big sales in 1916. Approximately 60 per cent are purchased in the rural districts and 40 per cent in cities.

Practically every State agent or agency tendered dinners to its sub-dealers during show week.

250 Cars in Baltimore Show

BALTIMORE, MD., Jan. 18—Baltimore's tenth annual automobile show opened at the Fifth Regiment Armory to-night. It is being held under the auspices of the Automobile Club of Maryland and the Baltimore Automobile Dealers' Associa-

tion. It will close on Saturday night.

The show is by far the greatest local exhibition of pleasure and commercial cars ever held in Baltimore, there being sixty-eight exhibitors showing 250 machines. The estimated value of the exhibits and decorations is \$1,500,000. Fifty-one different makes of pleasure cars and twenty-eight different makes of trucks are included in the exhibit.

Schrader, Tire Valve Inventor, Dies at Sea

NEW YORK CITY, Jan. 14—G. H. F. Schrader, formerly president of A. Schrader's Sons, Brooklyn, N. Y., and who invented the Schrader valve for tires, died on Nov. 15 last on board a fishing boat en route from Iceland to Norway. Mr. Schrader left this country about six years ago for England and after spending two years in Falmouth he suddenly went to Iceland. About three months ago he became ill and decided to return to the United States. He could get no passport, however, in Iceland, and so decided to take passage aboard a trawler for Norway, where he could establish his identity.

Mr. Schrader was a few months less than sixty years old. He was born in Hoboken. He was a bachelor, and, so far as is known, had only one relative, a sister now supposed to be in Germany.

Form Tractor Club in Kansas City

KANSAS CITY, MO., Jan. 17—The Tractor Club of Kansas City has been organized by the local representatives of about fifteen tractor manufacturers. A. J. Pray, of the Universal Tractor Company, is president, with W. F. Roth, Emerson-Brantingham Company, vice-president, and Guy H. Hall, Hall Bros. & Reeves, secretary and treasurer. The directors are E. J. Anderson, Avery Company; A. F. Norton, J. I. Case Threshing Machine Company; J. P. Smith, Rock Island Implement Company; G. C. Weyland, J. I. Case Plow Works, and C. E. Haynie, International Harvester Company.

Lehr Co. to Build Saginaw Eight

SAGINAW, MICH., Jan. 14—The Lehr Motor Co., this city, has been formed under Maine laws with a capital of \$500,000 to build the Saginaw Eight at \$1,050. The designer and general manager is Harry D. Mackey; president, William M. Guilder; vice-president, F. F. Myer, and secretary and treasurer, K. M. Schwahn.

Jackman Is Westinghouse Representative

CHICAGO, ILL., Jan. 14—A. E. Jackman has been appointed as the Western representative of the automobile equipment department of the Westinghouse Electric & Mfg. Co., this city.

Automobile Shipments Delayed

Only 59,000 Freight Cars Available—Several Railroads Building New Cars

DETROIT, MICH., Jan. 14—At a meeting of the traffic committee of the National Automobile Chamber of Commerce, Inc., together with traffic managers of various railroads, the traffic managers decided to ask that the automobile industry make it a rule to unload all incoming freight cars the day of their arrival. This step was taken in order to guard against the shortage of freight cars which is pending at the present time because the railroad companies have not kept pace with the expansion of the automobile industry by adding to their equipment of automobile freight cars.

At present there are only 59,000 automobile freight cars available. The New York Central is building 9000 additional, and the Pennsylvania is building 1000 extra. This puts the total at 69,000, which is not adequate to meet the demands. Up to the present time Detroit, Toledo, Flint, Lansing, Cleveland, and other manufacturing cities have not been severely handicapped in a shortage of cars. Shipments have been held up a day or so but the prospects are that when production is at its height in February there will be a very great shortage, and it is to guard against this shortage that the decision above referred to was arrived at.

N. A. C. C. Probes Situation

The N. A. C. C. through its traffic committee is following every automobile freight car from the time it leaves the factory until unloaded by the dealer and returned to the factory. This committee is working to guard against delays by the dealer in holding a car on the railroad siding for several days before unloading.

During 1915 approximately 200,000 carloads of automobiles were shipped by members of the N. A. C. C. or about 60,000 more than in 1914. During the last three months of 1915 members of the N. A. C. C. shipped 47,600 carloads or 24,000 more than during the corresponding period of 1914.

The following officers were elected at the meeting for the year 1916 by the Detroit traffic committee. C. W. Eggers, Willys-Overland Co., chairman; E. N. Hodges, Hupp Motor Car Co., vice-chairman; W. L. Schultz, Hudson Motor Car Co., secretary-treasurer.

Those in attendance in addition to the above were: M. S. Graham, Reo Motor Car Co.; C. J. Shaar, Packard Motor Car Co.; H. J. St. Aubin, Federal Motor

Truck Co.; George A. Main, Maxwell Motor Co.; Hugh Higginbottom, Dodge Bros.; H. R. Moule, Chalmers Motor Co.; H. E. Johnson, Studebaker Corp.; T. M. Smith, National Motor Vehicle Co.; W. L. Pierce, King Motor Car Co.; E. B. Rodgers, Olds Motor Works. There were also at the meeting, J. S. Marvin, traffic manager of the National Automobile Chamber of Commerce; William E. Metzger, chairman of the traffic committee of the N. A. C. C.; Arthur T. Waterfall, traffic commissioner of the Detroit Board of Commerce.

Springfield Body Offers \$750,000 Preferred Stock

NEW YORK CITY, Jan. 19—For the purpose of putting its Springfield plant on a large production basis and for the construction of a plant in Detroit, which will supplement that in Springfield, the Springfield Body Corp. has offered, through Renskorff, Lyon & Co., New York City, \$750,000 8 per cent cumulative and participating preferred stock at par. The stock is redeemable at 200 at the option of the company after Jan. 1, 1917. This is the first offering of an authorized issue of \$1,000,000 preferred stock.

All of the common stock of the company, amounting to \$1,500,000, was issued to holders of the old stock in payment for the company, which was formed when it took over the old Springfield Body Co. last year.

Waukesha Bridge to Build Tractors

WAUKESHA, WIS., Jan. 17—The Federal Bridge Co., Waukesha, Wis., formerly Modern Steel Structural Co., has booked another large contract to manufacture gasoline tractors for outside concerns, and during the present year will produce approximately 2500 farm machines. It was announced some time ago that the Waukesha plant would build tractors, but it was explained that this line was being undertaken only as a contractor. A short time ago the Nillson Farm Machinery Co., Minneapolis, Minn., contracted for the manufacture of 300 tractors, and now the Paramount Farm Tractor Co. has contracted for 1200 machines.

Signal Truck Increases Capital

DETROIT, MICH., Jan. 15—The Signal Motor Truck Co., is completing arrangements to increase its capital stock from \$85,000 to \$450,000. Of this amount \$300,000 will be common stock and \$150,000 7 per cent accumulative preferred. It will be provided for protection of preferred stockholders that no dividends will be paid on the common which will reduce the net current assets to a total of

125 per cent less than the amount of preferred outstanding. Furthermore, it will be provided that for each dividend on common stock cash of an equal amount is to be appropriated to a reserve for the retirement of the preferred stock. The common stock will be placed in a five-year voting trust.

The company will be known as the Signal Motor Truck Co. of Maine, under laws of which State it will be incorporated and it will take over the assets and business of the Signal Motor Truck Co. of Michigan. Application will be made for the listing of the stock on the Detroit Stock Exchange.

Stephens Car is New Product

FREEMPORT, ILL., Jan. 17—The manufacture of automobiles by the Moline Plow Co. will commence March 1, in the Henney Buggy plant. The car will be known as the "Stephens." The test chassis which has been constructed at Detroit as a model, reached Freeport this week, being driven overland by M. A. Steele, general manager; J. T. Trumble, chief engineer, and J. C. Holden, head draftsman. The car has six cylinders.

Rubber Club to Expedite Tire Shipments

NEW YORK CITY, Jan. 19—The Rubber Club of America, which is officially handling the crude rubber situation in America, during the period of the rubber embargo by Great Britain, has been working to make it easier for American exporters to get quicker service on tires for motor cars or trucks which have been shipped to neutral countries, and which must be shipped without tires under the restrictions of the embargo. The Rubber Club is circulating to the manufacturers a special form which when filled out will be forwarded by the Rubber Club to the war trade department in London. These forms are for licenses for tires for the vehicles shipped to neutral countries. At present sometimes months pass before tires can be secured through London for such vehicles, and the purpose of the present form is that this time can be greatly reduced. The forms are really a hurry-up certification from the Rubber Club to the war trade department that the orders are reliable and should be filled with the utmost dispatch.

Dorris Reduces I A W 2-Tonner Price to \$1,190

ST. LOUIS, MO., Jan. 15—The Dorris Motor Car Co., this city, has reduced the price of its I A W 2-ton worm drive truck chassis to \$1,990, f.o.b. St. Louis. There is now to be an extra charge for the governor and driver's seat, if wanted. The former price on this truck chassis was \$2,500.

Truck Trade Flourishing

General Motors Dealers' Convention Shows Orders Sufficient for All Year

PONTIAC, MICH., Jan. 18—With the new year less than a month old, orders in the hands of many dealers and distributors of trucks are ten times, and more, better than at this time last year. In some instances there have been 25 per cent more sales. The situation is without precedent, and, according to old truck dealers, it means that truck manufacturers will have to provide themselves with ample means as far as materials are concerned, if they want to cope with the demand, or rather with the orders they will receive right along from their dealers.

These were the chief points brought out at a three-days' convention of branch managers and salesmen of the General Motors Truck Co., held here this week. They came from all sections of the United States and some from the Dominion, and the feature of the gathering was the unanimous opinion of those present, that the truck business of 1916 will far surpass in the number of commercial vehicles sold, any figure anticipated or predicted at the present time.

The conditions are good everywhere for the truck business. The education of the prospective users of commercial cars has made such strides that to-day there is hardly any successful business man who does not intend to take on the motor-driven vehicle, or add some to those he already has.

From what some dealers say, orders for trucks now on the books of truck manufacturers are sufficient to keep them well busy practically all year. And many will have day and night shifts a greater part of the year.

New Tractor Ready Feb. 21

BIG RAPIDS, MICH., Jan. 1—The Four-Drive Tractor Co., this city, has been formed to build a tractor after the invention of John Fitch. A plant 45 by 200 ft. will be built on the company's property near the Père Marquette Railroad. The building is expected to be finished April 15.

The Four-Drive Tractor Co. expects to have a tractor ready for the Grand Rapids automobile show which begins Feb. 21. President Finch has been out scouting for material and already a quantity of machinery has arrived at the plant of the Binney Machine Co. in preparation for manufacturing operations in that city.

Gasoline Prices Soar to New Marks

Quotations in Six Cities Reach 22-Cent

Mark—Panama Slide Important Factor As

It Cut Off Cheap Transportation from Cal.

NEW YORK CITY, Jan. 18—The further increase of gasoline prices last week in this and other large cities throughout the country has caused many of the automobile owners to wonder just when the upward movement is going to stop. There seems to be no set price as the quotations given do not seem to coincide with the location of the city with reference to that of the refineries. For instance, Chicago is less favored in respect to manufacturing facilities than New York, yet the prices in the latter city are at the present time 4 cents higher than in Chicago. Both cities are well served by refineries and have excellent connections with the oil fields. Looking over the appended table of prices, it will be seen that there are just five cities in the United States that are paying prices as high as those now quoted in New York, and among them are several remote from the base of supplies, one being Tucson, Ariz. Detroit prices at the present time are quoting under 20 cents.

Transportation Rates Higher

It is stated, among many of the reasons for the recent increase of prices, the Panama slide was an important factor, as it cut cheap transportation from California, and the reopening would have afforded some relief. The oil now coming from California to the East must pay trans-continental gasoline railroad rates. The oil produced in Eastern Mexico was practically all going to England in tank steamers requisitioned by the British Government.

It is stated that a tank car of gasoline which cost \$500 a few months ago now costs \$1,500, same delivery, Oklahoma or elsewhere. A tank car of oil that could have been had at 1¼ to 1½ cents a gallon now costs 3 to 3¼ cents, and lubricating oils have advanced 40 to 100 per cent.

Exported Gasoline Higher

Last week the Standard Oil Co. of New York advanced the export price of gasoline stove grade 1 cent a gallon and all other grades 2 cents a gallon. Retailers in New York City have raised the price in some cases to 28 cents a gallon. One wholesaler gave the opinion that 3 cents a gallon was a fair profit for retailers, but the retailers state that no profit under 5 cents a gallon is possible to make fair earnings, as allowance for overhead charges and evaporation and waste must be accounted for.

The call for substitutes or new processes to cheapen production has been

manifest during the last few months. The latest process is that of H. T. Yarnan of Toledo, Ohio, who states that by his process gasoline can be produced for 10 cents a gallon by means of an invention of his which will get 90 per cent of gasoline out of the crude oil, instead of 20 per cent, which the present oil companies are stated to be getting. According to the inventor, by his process he can make all of the by-products of crude oil, including kerosene, paraffine, tar and greases, up into gasoline. When his process is finished, nothing but tar is left, the rest being gasoline.

The Atlantic Refining Co. in Philadelphia and Pittsburgh has raised the price of gasoline 1 cent to 21 and 22 cents, respectively.

Portland, Ore., prices were advanced last week 1 cent to 15 and 16½ cents, retail. Tacoma prices again advanced 1 cent to 16½ cents.

Investigation in New Jersey

The recent rise in gasoline prices in New Jersey has caused a resolution to be passed in the House of the Legislature for a thorough inquiry of the conditions leading to the higher prices. The Judiciary committee of the House will conduct the investigation. It is conceded by many in that State that gasoline is no longer a luxury, but a necessity, because of the extensive use of the commodity for commercial purposes.

\$1 Tax for Overcharge

A bill intended to reduce the price of gasoline was introduced yesterday by Representative Ben Johnson of Kentucky. It proposes that whenever the first vender sells a gallon of gasoline at a price as high as 15 cents, he shall pay a tax of \$1 for each gallon, and an additional tax of \$1 a gallon for each cent above that figure.

Farmers Oppose Gasoline Tax

FRESNO, CAL., Jan. 14—Automobile owners, dealers and farmers using tractors on their farms, representing the San Joaquin Valley, attended a mass meeting held in this city yesterday and protested vigorously against the emergency war taxes on gas engine, horsepower and gasoline to President Wilson and members of Congress.

Resolutions strongly objecting to the proposed taxes were passed and adopted. These resolutions are to be sent to Washington. In the resolutions the tax is declared to be unjust on the grounds that

automobiles are necessary to progress and prosperity and that the progress of California is largely dependent on the use of automobiles and gas engines in pumping plants and farm machinery.

The following table gives a range of the current prices:

	Present Price	April 1	Increase
Atlanta, Ga.	21	12.5	8.5
Baltimore, Md.	21	11	10
Boston, Mass.	22	13	9
Buffalo, N. Y.	18	12	6
Charleston, S. C.	21.5	15	6.5
Cheyenne, Wyo.	20	15	5
Chicago, Ill.	16.5	10.5	6
Cincinnati, Ohio	20	12	8
Cleveland, Ohio	15	11	4
Dallas, Tex.	19	10	9
Denver, Colo.	20	15	5
Detroit, Mich.	16	10.5	5.5
Douglas, Ariz.	22.5	16.5	6
El Paso, Tex.	20	11	9
Fort Worth, Tex.	19	10	9
Hartford, Conn.	21	11	10
Houston, Tex.	19	10	9
Kansas City, Mo.	15.8	9.8	6
Louisville, Ky.	18	11	7
Los Angeles, Cal.	15	12	3
Memphis, Tenn.	18	10	8
Minneapolis, Minn.	16.5	11.5	5
Nashville, Tenn.	16	10	6
New York City	22	12	10
Newark, N. J.	21	9	12
New Orleans, La.	17.5	11	6.5
Norfolk, Va.	18	12	6
Oklahoma City, Okla.	19	12	7
Omaha, Neb.	15	10	5
Pensacola, Fla.	18.5	15	3.5
Philadelphia, Pa.	21	11	10
Pittsburgh, Pa.	22	9	13
Portland, Me.	22	13	9
St. Louis, Mo.	15.9	9.9	6
St. Paul, Minn.	16.5	11.5	5
San Francisco, Cal.	15	11.5	3.5
Savannah, Ga.	20	13	7
Seattle, Wash.	14	12	2
Shreveport, La.	18.5	10	8.5
Tucson, Ariz.	22.5	17	5.3
Vicksburg, Miss.	19.5	13.5	6

Government Constructs Armored Car at Rock Island

ROCK ISLAND, ILL., Jan. 17—There is being finished at the government arsenal in Rock Island, an armored car for the United States war department, which is the first of the kind to be constructed in this country. Originally, the car was a Jeffery commercial truck. A 45-hp. engine has been substituted for the thirty, first installed, and when the car is ready for service a test will be made upon the arsenal drives. The entire machine, with the exception of the wheels, is protected with 2/10-in. armor, though armor plate will be substituted later. There are loop holes for the use of field glasses and two revolving turrets, on each of which is mounted a rapid-fire gun, each discharging 450 shots per minute, though this can be increased to 600 if necessary. The car will carry six men. Driving apparatus, which permits the car to go ahead or backward, is in position but is operated separately, thus requiring one man for each, the other four men to handle the rapid fire guns.

Work also has been started on a lighter and speedier armored automobile, which will be armed with one machine gun and carry a crew of two or three men.

Experiments have demonstrated that armor plate 2/10 in. thick will resist small-arms fire. This is as thick as the

shields used on the machine guns in use in the European war.

The War Department also is planning a motor vehicle equipped with small rapid-fire guns, but limitation as to weight materially restricts the amount of armament that can be placed on such a vehicle. On account of the character of the roads here it will be impossible to use as heavy armored trucks in this country as in Europe, the limit of safe weight having been found here to be 8500 lb. England has purchased in this country supply trucks that weigh loaded between 12,000 and 13,000 lb. Trucks as heavy as this would wreck many of our country bridges.

To Compel Truck Fenders

CHICAGO, ILL., Jan. 18—Although the ordinance, stipulating that all motor trucks operating in this city shall be equipped with fenders, has been declared invalid, mandamus proceedings have been instituted against Chief of Police Healey to compel its enforcement by five makers of fenders. The bill of complaint states that of the fifty-nine persons killed by motor trucks in Chicago during the past 11 months, twenty-six were children whose lives would have been saved had the vehicles carried fenders.

Durant-Dort Capital Increased

FLINT, MICH., Jan. 15—The capital stock of the Durant-Dort Carriage Co. has been reduced from \$2,000,000 to \$1,000,000.

War Automobiles Sent Direct to Petrograd

GRAND HAVEN, MICH., Jan. 14—Transfer shipments of war automobiles and accessories have been handled by the local lake lines, the shipments being routed direct to Petrograd in the main. The Grand Trunk railroad is handling the major portion of the shipments.

British Tire Blockade Hits Dutch

PARIS, Dec. 30—Travelers from Holland report that England's tire blockade is so tight that only the minimum number of tires necessary for public service are allowed to pass into Dutch territory. Automobile owners are not allowed to have new tires until they have returned their old casings and tubes, even though they are unfit for any further service.

Notwithstanding the severity of the control and the heavy fines imposed, smugglers make repeated attempts to get rubber across the frontier into Germany. The market price of rubber in Holland is at present about \$1.60 per pound. The penalty for those caught in the act of smuggling is \$6.40 a pound; but as Ger-

man agents are willing to pay \$10 a pound for all rubber brought across the frontier, smuggling is a profitable, though dangerous, occupation.

Must Notify Insurance Co. Immediately

LANSING, MICH., Jan. 14—The Supreme Court of Michigan in a decision affecting the Oakland Motor Car Co., Pontiac, Mich., held that when a liability insurance company is notified about an accident three months after it occurred that this is not an immediate notification. In this particular case the Oakland company had a liability insurance policy with the American Fidelity Co., covering automobiles used by the Pontiac manufacturer for testing in Pontiac. One of the cars while on a testing run was the cause of a runaway, and a Mrs. Sarah Gregory was hurt. She brought action for recovery of damages, and was given a verdict for \$1,500. The Oakland Motor Car Co. brought suit against the insurance company for this amount, but the American Fidelity Co. refused to settle, claiming that its agreement with the Oakland company specifies that it must be notified immediately about accidents, and in this instance the insurance company was notified three months after the accident occurred. In a lower court a decision was rendered in favor of the Oakland Motor Car Co., but now the supreme court reversed the decision without a new trial.

Synthetic Rubber in German Tires

BERLIN, GERMANY, Jan. 14—Automobile tires of artificial rubber are now being made in Germany. In his address to the Reichstag last week Chancellor von Bethmann Hollweg stated that German inventors had discovered a method of producing synthetic rubber. It was stated that at almost the same hour that the Chancellor's statement was made, a factory succeeded in working this rubber into tires which will wear for a year.

Hercules Plant Erection Started

CANTON, OHIO, Jan. 17—Ground has been broken for the erection of the plant of the Hercules Motor Mfg. Co., which will build a light delivery wagon. The plant will be 75 by 360 ft. and will be completed within sixty days.

Consolidated Car Co. Enlarges Plant

DETROIT, MICH., Jan. 17—The Consolidated Car Co. which makes the Abbott-Detroit cars concluded a deal whereby it has taken over the plant of Schweppe & Wilt at Meldrum and Lafayette Avenue, East. The latter company will move into a new plant on Mt. Elliott.

60,000 Cars at French Front

Repair Factories with Power Equipment Behind Lines Can Be Moved Rapidly

PARIS, FRANCE, Jan. 14—According to dispatches sent out from this city, there are at present about 60,000 automobiles, worth \$60,000,000, in use on the fighting lines in France. The machines are having the hardest kind of use and yet but 25 per cent are under repair. Each army now possesses a large repair camp. It is a novel feature of army organization. Up to two months ago machines needing repairs had to be sent to garages in the nearest large city. To avoid loss of time, regular factories equipped with machinery for automobile construction have been built behind each army. They consist of about a dozen enormous wooden sheds covered with waterproof canvas.

Electricity generated on the spot operates all the lathes. Two hundred mechanics work night and day in two shifts. Spare parts of every description for every make of car, tires, lamps, headlights and every possible accessory are kept in large stock. Everything is so arranged that the whole camp, including the sheds, can be moved bodily to another part of the country within a week. Emergency workshops, composed of three automobile wagons, carrying all repair tools and an ample supply of spare parts, are kept in perpetual readiness, should the army suddenly advance.

Special Burd Ring for High Speed Motors

ROCKFORD, ILL., Jan. 14—A new Burd piston ring has been developed by the Burd High Compression Ring Co. which will be known to the trade as the "Burd high speed model." In appearance it is not dissimilar to the standard Burd ring, and to the layman there is little or no evidence of change from the former specifications. It is intended to meet the difficult requirements of aeroplane motors and high power car engines.

The aluminum alloy piston calls for greater clearances between the piston and cylinder walls, to provide for the greater expansion. The Burd high speed model piston ring is especially adapted to meet these unusual conditions.

Jones Now Johns-Manville Speedometer

NEW YORK CITY, Jan. 13—H. W. Johns-Manville Co., announces that the name "Jones" has been discontinued in connection with its speedometer, which is now known as the Johns-Manville speedometer.

Five Year Trust for Entz Patents

Six Members Represent General Electric Co. and Owen Magnetic Co.

NEW YORK CITY, Jan. 15—A voting trust has been constituted in connection with the Entz Motor Patent Corp., controlling the Entz electric transmission patents, large interests in which were recently purchased by the General Electric Co., from R. M. Owen & Co., which previously controlled them exclusively. The voting trust will exist for five years and the power of voting the stock of the corporation rests with the following parties: R. M. Owen, president; R. A. Rainey, first vice-president, Entz Motor Patent Corp; D. C. Durland, of the Sprague electric, which is a General Electric property; Geo. F. Morrison, Edison Lamp Works, which is controlled by the General Electric, and R. H. Montgomery and Richard Swartout, representing financial interests.

McClurg Rubber Takes Over S. & M. Co.

COSHOCOTON, OHIO, Jan. 14—Formal transfer of the property of the S. & M. Tire & Rubber Co., to the new McClurg Rubber Co. was made by Receiver E. A. Crawford, the consideration being \$35,735.88. A journal entry was filed in common pleas court showing that the old stockholders may complete payment on their stock and receive shares of stock in the new company.

It was stated that the rubber plant will now commence operating to full capacity, with from forty to sixty employees, the number to be increased.

Bull Chairman J. I. Case Board—Davis New President

RACINE, WIS., Jan. 17.—The reorganization of the official personnel of the J. I. Case T. M. Co., Racine, Wis., which has been going on for six months, was completed on Jan. 12 at a special meeting of the board of directors. F. K. Bull, for many years president, was advanced to a new position just created, that of chairman of the board of directors. W. J. Davis, treasurer, was elected president and will continue as treasurer. The complete list of officers and directors now is:

Chairman of the board, F. K. Bull; president and treasurer, W. J. Davis; vice-presidents, E. J. Gittins and M. H. Pettit; secretary, W. F. Sawyer; assistant secretary, Stephen Bull; assistant treasurers, C. J. Farney and R. P. Howell; directors, the officers and Frederick Robinson, W. E. Black, F. L. Hine and A. O. Choate.

F. K. Bull's father was one of the four founders of the big institution. He has been its head for nearly thirty years. In the new position of chairman of the board, Mr. Bull will have complete supervision of all branches of the business. The new president, W. J. Davis, came to Racine from Marinette, Wis., five years ago to become president of the Manufacturers' National Bank. Two years ago he was elected treasurer of the Case company and now he takes the larger duties of president, being provided with two assistant treasurers.

Increase of Wis. Registrations

MADISON, WIS., Jan. 17—During the first 15 days of 1916, 22,250 applications from private owners for 1916 licenses were received by the Secretary of State of Wisconsin. During the same period of 1915, the number of applications was only 9750. Only 6000 sets of plates have been issued thus far, because of the inability of the contractor for plates to make prompt delivery as specified. Permission has been given to operate under former licenses until new plates can be provided.

Overland Capital Raised to \$75,000,000

TOLEDO, OHIO, Jan. 14—At a special meeting to-day of the stockholders of the Willys-Overland Co., this city, the proposed program to increase the capital stock of the company as outlined in THE AUTOMOBILE of Nov. 11 has been authorized. The new capital amounts to \$75,000,000 and consists of \$50,000,000 common and \$25,000,000 preferred. The common stock has been increased from \$25,000,000 and the preferred is a new stock issue.

This action formally approves the proposal outlined last November for the capital increase and also the issue of \$15,000,000 new convertible 7 per cent preferred stock, which has been offered to common stock to the extent of 71½ per cent of holdings at 110 and to the holders of the old preferred stock on similar terms. The old issue of preferred has been called for redemption at 110. The company has outstanding at present \$21,000,000 common stock.

St. Louis Chevrolet Raises Capital to \$1,000,000

ST. LOUIS, Mo., Jan. 12—The capital stock of the Chevrolet Motor Co. of St. Louis has been increased from \$10,000 to \$1,000,000 according to a statement filed with the Secretary of State of Missouri. About the same time a statement was filed by the Banner Buggy Co. showing a decrease in capital stock from \$700,000 to \$400,000. Russell E. Gardner, president of the buggy company, is also president of the local Chevrolet Co.

Canada Ford Makes \$3,202,000

1915 Output 24,500 Cars—To be Raised to 40,000 in 1916

DETROIT, MICH., Jan. 14—Earnings of the Ford Motor Co. of Canada, in the past year ended Sept. 30, 1915, amounted to \$3,202,000, on an output of 24,500 cars. The company at present has outstanding \$7,000,000 capital stock, of which \$6,000,000 represents the recent 600 per cent stock dividend. Last year's earnings therefore are equivalent to 45 per cent on the increased amount of stock.

The output for the current year will be 40,000 cars. The present capacity of the plant is 60,000 cars.

The cash dividends paid by the company have amounted to \$1,600,000, or an average of about 116 per cent per annum. This has been in addition to stock dividends.

The record of profits and production of the company is as follows:

Year	Production	Net Earnings
1915	24,500	\$3,202,000
1914	16,000	2,022,000
1913	11,500	1,317,000
1912	6,500	1,065,000

800 Stockholders Hold Reo Shares

LANSING, MICH., Jan. 5—The shares of stock of the Reo Motor Car Co. are held by about 800 stockholders, according to Secretary-Treasurer Donald E. Bates, of the Reo company. Most of the holders reside either in Lansing or in Detroit and 15 per cent hold less than ten shares each. The par value of the Reo shares is \$10. Ever since the company was started the control of stock has remained with the men who started it.

The capital stock, when the company was incorporated in August, 1904, was \$500,000. It was later increased to \$1,000,000 then to \$4,000,000 and last December to \$10,000,000. Of the \$4,000,000 capital stock \$1,000,000 was held in reserve in the treasury. Dividends were:

	Cash, Per Cent	Stock, Per Cent
1905	10	..
1906	37½	50
1907	86½	33½
1908	80	..
1909	60	100
1910	30	..
1911	3	..
1912	20	..
1913	10	..
1914	37½	50
*1915	35	100
11 years	409½	333½
Average per year	37½	30

*Does not include regular quarterly dividend of 2½ per cent payable Jan. 1, 1916.

Since 1905 and up to the end of October, 1915, the total number of passenger cars made and sold by the Reo

Motor Car Co., was 72,050. The annual production was as follows:

Year	Cars
1905.....	864
1906.....	2,458
1907.....	3,967
1908.....	4,105
1909.....	6,592
1910.....	6,588
1911.....	5,278
1912.....	6,342
1913.....	7,647
1914.....	13,516
1915.....	14,693
Total, 11 years.....	72,050
Average per year.....	6,550

*For fiscal year of 11 months.
 **For fiscal year of 14 months.
 ***For period of 10 months.

Seven Lansing Firms Paid Big Dividends in 1915

LANSING, MICH., Jan. 6—During 1915 seven local manufacturing concerns directly connected with the automobile industry, have paid to their shareholders cash dividends totaling 140 per cent and stock dividends totaling 206 per cent. The amount credited to each concern was as follows: Reo Motor Car Co., 35 per cent cash, 100 per cent stock; W. K. Prudden Co., 30 per cent cash; Auto Body Co., 25 per cent cash, 96 per cent stock; Auto Wheel Co., 20 per cent cash; Atlas Drop Forge Co., Bates & Edmunds Motor Co., and Reo Motor Truck Co., each 10 per cent cash.

Sheet Steel Parts Makers to Double Capacity

DETROIT, MICH., Jan. 17—The Holihan Mfg. Co., Twenty-first Street and West Jefferson Avenue, which makes sheet metal parts, such as gas tanks, flat and crown fenders, hoods and general stampings, is to double its plant. According to officials of the company business was 300 per cent better during 1915 than it was in 1914.

Ampco Re-elects Board

MILWAUKEE, WIS., Jan. 14—At the annual meeting of the stockholders of the American Metal Products Company (producers of "Ampco" bronze), the old Board of Directors was re-elected, being constituted as follows: Peter J. Weber, president; Henry C. Brelie, vice-president; Wm. J. Eberle, secretary and treasurer; Richard Gaertner, manager, and Charles E. Helm and August Littmann.

The officers reported that although the present plant was being worked to full capacity it was impossible to keep up with the demand, that orders on hand were plentiful, and that the many large orders pending absolutely necessitated the immediate installation of additional facilities.

Goodyear Rushes New Plants

AKRON, OHIO, Jan. 14—The new plants of the Goodyear Tire & Rubber Co., this city, are being rushed to completion. These will give the company a capacity of 20,000 automobile tires a day.

Ogren Expands To \$1,000,000 Co.

Name Changed to Ogren Motor Works, Inc.—H. W. Ogren Chief Engineer

WAUKEGAN, ILL., Jan. 14—The Ogren Motor Car Co., has changed its name to the Ogren Motor Works, Inc., and has increased its capital stock from \$25,000 to \$1,000,000. The company this year will inaugurate an extensive expansion policy which includes the above increase of capital and the construction of a plant in Waukegan.

H. W. Ogren, designer of the car, has been appointed chief engineer and general manager of the new company which was incorporated under the laws of Delaware.

On Feb. 1 ground will be broken for a new plant in this city, which will cost \$150,000, and as soon as the buildings are ready for occupancy the company will move from Chicago, its present location. The main building of the plant will measure 150 by 900 ft.

It is the intention of the company to continue the manufacture of its present model, a six listed at \$2,500, and in addition to put on the market another type of six-cylinder car that will sell for less than \$1,000. Production plans for 1916 call for the manufacture of 3000 cars.

The company is building two racing cars for a campaign next season. Tom Alley, has been engaged to pilot the cars in most of the races for this year.

Steel Lower—Oils Higher

NEW YORK CITY, Jan. 18—Market prices in general last week were subject to many changes. Bessemer and open-hearth steel dropped \$1 a ton to \$32 and \$33, respectively, while a majority of the oils and lubricants saw small gains. Another important change and of much interest to the tire makers at the present time is the reduction in Para and Ceylon

rubber prices. Last week the reductions of both grades amounted to 7 and 8 cents, respectively. Copper went up $\frac{1}{4}$ cent a pound in both electrolytic and Lake grades.

Tin has kept up its downward movement, which has reached the \$41 mark per 100 lb.

The demand for automobile materials is at the present time very large and the manufacturers, as has been stated in previous issues of THE AUTOMOBILE, are having difficulty in procuring certain metals and other materials. It has been estimated that the crude rubber output during the current year will establish a new high record at 175,000 tons dry weight, worth over \$260,000,000. The value of rubber is a fluctuating quantity, but it is estimated that the average wholesale price for the current year will be 75 cents per pound.

Approximately 131,000 tons of crude rubber were gathered throughout the world last year. As the big American consumers of rubber buy several months ahead, it is apparent that they are still working on lower-priced rubber. Even \$1 a pound, while it represents an advance of 30 per cent for the year, seems low when contrasted with the average prices in 1910 for the two grades, viz., \$2.18 for plantation, and \$2.75 for Para.

Lion Tire and Rubber Corp. Formed

LAFAYETTE, IND., Jan. 14—The Lion Tire & Rubber Corp., this city, has been incorporated with a capital of \$150,000 to manufacture automobile tires. The company has purchased the Heinze plant on Union Street where it will carry on its manufacturing. The incorporators are Ferdinand Dryfus, Thomas Follen, P. F. Freel, W. A. Klepper, R. K. Bedgood, H. J. Haarmeyer of this city; G. B. Smity of Pittsburgh; J. T. Cullen of Peru; Thomas Crane of Chicago, and Edward Taylor of Montmorenci.

The following officers have been elected: President, Ferdinand Dryfus; first vice-president, Thomas Follen; second vice-president, Edward Taylor; treasurer, P. F. Freel; secretary, H. J. Haarmeyer.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Mon.	Week's Ch'ge
Aluminum.....	.53	.53	.53	.53	.53	.53	..
Antimony.....	.41	.40	.43	.41 $\frac{1}{4}$	.41 $\frac{1}{4}$	.42 $\frac{1}{2}$	+.01 $\frac{1}{2}$
Beams and Channels, 100 lb.....	2.17	2.17	2.17	2.17	2.17	2.17	..
Bessemer Steel, ton.....	33.00	33.00	32.00	32.00	32.00	32.00	—1.00
Copper, Elec., lb.....	.23	.23	.23 $\frac{1}{2}$	.23 $\frac{1}{4}$	.23 $\frac{1}{4}$	.23 $\frac{1}{4}$	+.00 $\frac{3}{4}$
Copper, Lake, lb.....	.23	.23	.23 $\frac{1}{2}$	.23 $\frac{1}{4}$	.23 $\frac{1}{4}$	.23 $\frac{1}{4}$	+.00 $\frac{3}{4}$
Cottonseed Oil, bbl.....	8.89	8.94	8.95	9.00	9.00	9.20	+.31
Cyanide Potash, lb.....	.28	.28	.28	.28	.28	.28	..
Fish Oil, Menhaden, Brown.....	.48	.50	.50	.50	.50	.50	+.02
Gasoline, Auto, bbl.....	.22	.22	.22	.22	.22	.22	..
Lard Oil, prime.....	.92	.92	.93	.93	.93	.93	..
Lead, 100 lb.....	5.90	5.90	5.85	5.85	5.85	5.90	..
Linseed Oil.....	.70	.70	.70	.70	.72	.72	+.02
Open-Hearth Steel, ton.....	34.00	34.00	33.00	33.00	33.00	33.00	—1.00
Petroleum, bbl., Kansas, crude.....	1.20	1.20	1.20	1.20	1.20	1.20	..
Petroleum, bbl., Pennsylvania, crude.....	2.25	2.25	2.25	2.25	2.25	2.25	..
Rapeseed Oil, refined.....	.96	.98	.98	.98	.98	.98	+.02
Rubber, Fine Up-River, Para.....	.95	.95	.92	.88	.83	.88	— .07
Rubber, Ceylon, Pale Crepe.....	1.02	.95	.95	.92	.90	.94	— .08
Sulphuric Acid, 60 Baume.....	2.00	2.00	2.00	2.00	2.00	2.00	..
Tin, 100 lb.....	41.50	41.25	41.25	41.25	41.25	41.00	— .50
Tire Scrap.....	.05 $\frac{1}{2}$	.05 $\frac{1}{4}$	.05 $\frac{1}{4}$	.05 $\frac{1}{4}$	.05 $\frac{1}{4}$	.05 $\frac{1}{4}$	+.00 $\frac{1}{4}$

The output will be 200 tires a day and the same number of men will be employed. It is expected that the first tires will be ready for the market on May 1.

100,000 Studebakers for 1916

DETROIT, MICH., Jan. 14—The Studebaker Corp., has planned a production schedule for 1916 which calls for 100,000 cars. The factory has been running full capacity, and more than 5000 of the new models have been shipped since Jan. 1.

Studebaker Succeeds Swander

NEW YORK CITY, Jan. 14—C. D. Studebaker, who has been connected with the local branch of the Firestone Tire & Rubber Co., has been appointed branch manager to take the place of D. C. Swander, who becomes eastern district sales manager. H. Topping, who was Mr. Studebaker's assistant, has succeeded him as office manager.

Ohio's Chauffeur License Law Not Enforced

COLUMBUS, OHIO, Jan. 15—According to instructions issued by W. H. Walker, Ohio Registrar of Automobiles no attempt will be made to enforce the chauffeurs' license law in the State until the highest court finally passes on the question of constitutionality of the law. In a letter written to Joseph Cisan, Jr., examiner of chauffeurs at Cleveland the instructions are given that applicants for chauffeurs' licenses must be informed of the unsettled condition of the law and to discourage all chauffeurs from registering.

Security Prices Lower

General Motors Common Goes Up 10 Points—Rest of Market Apathetic

NEW YORK CITY, Jan. 19—Automobile and accessory issues last week were dull with the exception of General Motors, which picked up in price yesterday, reaching the 489 mark, just 24 points higher than Saturday's quotation. The rest of the issues showed few marked gains. Those stocks which have occupied more or less prominence on the Exchange during the last few months have lately shown a declining tendency, especially Maxwell, Overland and Studebaker. Last week Maxwell common dropped 3 points; Overland dropped 1 point; and Studebaker closed with a 2-point loss. In regard to Overland securities, the committee on securities on the New York Stock Exchange has ruled that all transactions in the common stock of that company be ex-rights Jan. 17, and that transactions in rights must be

settled Jan. 19, when due bills must be redeemed. The right to subscribe at 102½ for new convertible 7 per cent preferred stock to the extent of 71½ per cent of the holdings expires Jan. 21.

Last week several small gains were made; Reo Motor Car went up 2 points as did Stewart-Warner common; White rose ¼ point; and Studebaker preferred closed with a 1-point gain.

A few of the drops are as follows: Chalmers, 5 points; Chevrolet, 4 points; International Motors common and preferred, 4 and 5 points; Peerless, 1 point, and U. S. Rubber common and preferred, ¾ and 1½ points, respectively.

Chalmers common featured the Detroit securities last week with a 10½-point drop. Continental Motor common went up 5½ points. The rest of the market showed small gains and losses ranging from 1½ to 3 points.

Shafer Leaves Flint Varnish

FLINT, MICH., Jan. 11—A. E. Schafer, who for the past two years has been associated with the Flint Varnish & Color Works as vice-president and general sales manager has severed his connection with that company.

Overland Talks for Dealers

CHICAGO, ILL., Jan. 18—During the week of the Coliseum motor car show Jan. 22-29, the Willys-Overland company will conduct a series of educational talks for dealers at Overland headquarters, Congress Hotel, at 3 p. m. each day of the show with the exception of the closing date, Saturday, Jan. 29. Henry H. Hower, of the Knight motor department will deliver the talks which are connected with the Knight motor.

Pratt Leaves Pierce-Arrow

BUFFALO, N. Y., Jan. 11—J. Elmer Pratt, who has been sales manager of the Pierce-Arrow for seven years, has severed his connection with that organization. Mr. Pratt has not yet announced his future plans but is going to continue actively in the industry. He enjoys the country-wide confidences of all who have come in contact with him during his long years of service in the industry.

Automobile Securities Quotations on the New York and Detroit Exchanges

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax Rubber Co. (new).....	95	100	71	71½	+1
Aluminum Castings pfd.....	85	85	88½	88½	..
J. I. Case pfd.....	96½	120	150	150	-5
Chalmers Motor Co. com.....	93½	101	103	103	..
Chalmers Motor Co. pfd.....	122	122	123	123	-4
Chevrolet Motor Co.....	63	64	64	64	-1
Electric Storage Battery Co.....	365	370	720	720	..
Firestone Tire & Rubber Co. com.....	110	111	112	112	..
Firestone Tire & Rubber Co. pfd.....	86	87	465	475	+10
General Motors Co. com.....	93	94	113½	115	-½
General Motors Co. pfd.....	31½	32	72½	72½	-¼
B. F. Goodrich Co. com.....	95¼	96	112	113	-1
B. F. Goodrich Co. pfd.....	193	195	338	342	-2
Goodyear Tire & Rubber Co. com.....	102	103½	114	114	..
Goodyear Tire & Rubber Co. pfd.....	..	..	..	..	..
Gray & Davis, Inc., pfd.....	..	..	16	22	-4
International Motor Co. com.....	..	..	35	40	-5
International Motor Co. pfd.....	..	..	290	292	-2
Kelly-Springfield Tire Co. com.....	78	79	73	74	..
Kelly-Springfield Tire Co. 1st pfd.....	79	80	95	97	+½
Kelly-Springfield Tire Co. 2d pfd.....	100	102	73	74	..
Maxwell Motor Co. com.....	18	18½	68	69	-3
Maxwell Motor Co. 1st pfd.....	53½	54½	89	89½	-1
Maxwell Motor Co. 2d pfd.....	21½	22½	53½	53½	-1½
Miller Rubber Co. com.....	..	..	260	270	..
Miller Rubber Co. pfd.....	..	..	113	115	..
New Departure Mfg. Co. com.....	..	..	120	..	..
New Departure Mfg. Co. pfd.....	101	..	..	..	..
Packard Motor Car Co. com.....	..	..	100	185	195
Packard Motor Car Co. pfd.....	93	..	102½	104½	..
Paige-Detroit Motor Car.....	..	..	..	..	..
Peerless Motor & Truck Corp.....	..	..	29	30	-1
Portage Rubber Co. com.....	25	30	70	72	..
Portage Rubber Co. pfd.....	80	85	102	105	..
Regal Motor Co. pfd.....	..	..	18	18	..
Reo Motor Co. pfd.....	11½	12½	23	25	..
Reo Motor Car Co.....	25	26	32	33	+2
Splitdorf Electric Co. pfd.....	..	..	..	..	..
Stewart-Warner Speed. Corp. com.....	53	53½	89	91	+2

	1915		1916		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Stewart-Warner Speed. Corp. pfd.....	100	102	108	108	..
Studebaker Corp. com.....	41½	41½	157	157½	-2
Studebaker Corp. pfd.....	94	95	111	113½	+1
Swinehart Tire & Rubber Co.....	69	71	89	90½	..
Texas Company.....	133	134	222	223	-5
U. S. Rubber Co. com.....	55½	57	55½	55½	..
U. S. Rubber Co. pfd.....	102	102½	107½	108½	-1½
Vacuum Oil Co.....	200	202	230	235	..
White Motor Co. (new).....	..	..	49½	50½	+½
Willys-Overland Co. com.....	86	88	225	230	-1
Willys-Overland Co. pfd.....	90	94	..	..	..

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS				
Chalmers Motor Co. com.....	96½	..	142½	-10½
Chalmers Motor Co. pfd.....	90	93½	100	102½ +½
Continental Motor Co. com.....	175	200	253	260 +5½
Continental Motor Co. pfd.....	..	..	91	..
Ford Motor Co. of Canada.....	445	..	410	..
General Motors Co. com.....	86	88	450	475
General Motors Co. pfd.....	93	95	113	115
Maxwell Motor Co. com.....	17½	19½	68	70½ -1½
Maxwell Motor Co. 1st pfd.....	53	55	88	90½ -1½
Maxwell Motor Co. 2d pfd.....	21	23	52	54½ -1½
Packard Motor Car Co. com.....	..	100	185	188 -2
Packard Motor Car Co. pfd.....	93	..	..	104½
Paige-Detroit Motor Car Co.....	..	..	700	..
Reo Motor Car Co.....	25½	26½	32	33 -½
Reo Motor Truck Co.....	11½	12½	24	25 +1½
Studebaker Corp. com.....	41	43	156½	159½ -3
Studebaker Corp. pfd.....	94	96	110	114 -1½

INACTIVE STOCKS				
Atlas Drop Forge Co.....	25	31½	..	+3
Kelsey Wheel Co.....	185	..	295	..
W. K. Prudden Co.....	19½	..	32	34 +2
Regal Motor Car Co. pfd.....	25	10	15	-5

*Old. †New. ‡And accrued dividends. §Par value \$10.

Hoff Pullman President

Succeeds J. C. Schmidt—Co. Is Operating Plant at Full Capacity

YORK, PA., Jan. 14.—C. L. Hoff, general manager of the Standard Chain Co., this city, has been elected president of the Pullman Motor Car Co., to succeed John C. Schmidt, for the past four months the head of the Pullman company. The duties of former-President Schmidt, who is also president of the Standard Chain Co., having become too strenuous, is given as the cause for the change.

The Pullman company has embarked on one of its most successful seasons, the factory being operated to its fullest capacity. More than 600 men are now employed on the day and night shifts. Improvements have recently been made to the plant at a cost approximating \$100,000.

W. F. Grove, for the past seven months connected with the Bell Motor Car Co. as general sales manager and factory superintendent, has resigned his position to become the head of the York Motor Car Co., a new organization established for the sale of Pullman cars exclusively. The company has located its headquarters at 217 North George Street, where a show and salesroom and service station will be maintained. A full line of automobile tires and accessories will be handled by the company. The district covered by the agency includes York, Adams and Lancaster counties. The York Auto Exchange was formerly the agency for the Pullman car in York.

Good Patents Often Unworkable

(Concluded from page 119)

inventor will still be deprived of the right to make the improved form of the device without the consent of the second patentee until the second patent expires.

Under these circumstances, obviously the thing for the parties to do is to reach some business agreement, and this is usually the outcome, and it accounts in a large measure for manufacturing concerns holding a series of patents covering the development of the articles they manufacture. Often a single article, such as a spark plug will be covered by a half dozen or more patents, the earlier ones having broad claims on the particular type of plug, and the later ones going into the detail structure or perhaps to the process of manufacture of the plug or of a part of it, such as the porcelain.

Patents cannot, therefore, be segregated and held up individually as repre-

senting the product solely of the patentee; each is simply a step in the advancement of the art; merely the carrying forward of ideas previously expressed in broader terms, each patent being coupled with perhaps a dozen others, all of which are necessary to form the links of a chain of protection for a particular article of manufacture.

Licensing System for Dealers and Users Legal

NEW YORK CITY, Jan. 14—Holding that the Victor Talking Machine Co.'s system of price maintenance is legal, the United States Circuit Court of Appeals in New York has reversed the decision of the United States District Court. The Victor company brought suit against R. H. Macy & Co., this city, the complaint being in regard to its licensing system, by which dealers are licensed to sell Victor goods, and purchasers are licensed to use them. Each Victor machine bears a plate stating that it is not sold, but rented on a royalty under certain patents, and that it becomes the property of the user on the expiration of the patents. It is also provided that for violation of the license the machine may be taken back by the company and the royalty refunded less 5 per cent per year for use. By these provisions the Victor company is given full control until the expiration of the patent.

All-Steel Co. Elects New Board of Directors

ST. LOUIS, MO., Jan. 14—The All-Steel Motor Car Co., this city, has elected a new board of directors as follows: C. L. Smith, E. F. Stockholm, F. V. L. Smith, A. C. Duncan, John Hambeacon, Fred Smith and O. O. Trorlicht.

Brig.-Gen. E. J. Spencer has stepped down as president of the company, and it is stated that a new head will be selected at the next meeting of the board of directors.

The company has a capital stock of \$400,000, of which half is paid in. Its plant in Macon, Mo., which will employ about 750 men, will be opened within sixty days.

Patterson and Burrows Are Partners

DETROIT, MICH., Jan. 12—Fred J. Patterson, formerly with the Ferro Machine & Foundry Co., and the Steel Products Co., both of Cleveland, and F. J. Burrows, who was buyer for the old Briggs-Detroit Co., have formed a partnership as manufacturers representatives. Headquarters have been taken in the Kresge Building. The new firm has thus far secured the representation of the Toledo Steel Tube Co., the Hoosier Castings Co., the Curtis Screw Works and W. W. Wainwright & Sons.

Randall-Faichney Reorganized

Management Unchanged—New Company Takes Over Assets of Old One

BOSTON, MASS., Jan. 17—The Randall-Faichney Co. has been reorganized, the new company taking over all the assets of the old one including the building and good will of the business. The production of motor car accessories will be continued and a number of new products added. The management will be the same as during the past nineteen years and the heads of the various departments are practically the same. The officers of the company are: President, W. A. Randall; vice-president, G. H. Faichney; treasurer, Chas. P. Blinn.

Father Held Responsible for Son's Accident

CINCINNATI, OHIO, Jan. 14—There is special interest in a decision handed down in the United States circuit court of appeals in the case of Ida McNorton against W. C. Denison, which was appealed from the district court at Cleveland, Ohio. One of the main points involved was the question of whether a father is responsible for the acts of his son when the latter is driving the father's car.

In this case the upper court held that Mr. Denison was liable for the injury of Miss McNorton because his son, William, aged seventeen, was driving at the time, and sustained the verdict of \$10,000, awarded by a jury. The testimony showed that William had taken the machine without the knowledge of the father, while the latter was out of the city. The court held that the son lawfully represented his father when he took out the car.

Fuller Plant Progresses

KALAMAZOO, MICH., Jan. 8—Progress is being made on the new plant of Fuller & Son Mfg. Co., this city. This company manufactures parts for automobiles and trucks. The new factory is of concrete and steel construction.

All Pennsylvania Automobile Employees Must Be Insured

PHILADELPHIA, PA., Dec. 24—On Jan. 1, when the new Pennsylvania workmen's compensation act goes into effect, everyone engaged in the automobile business, whether manufacturing or selling, will have to be insured. Compensation will be paid to employees on the basis of 50 per cent of their wages, the minimum

being \$5 and the maximum being \$10, the length of time during which it will be paid depending on the nature of the injury. The premium rates are based on each \$100 of annual payroll, as follows:

	Premium	Pub. Lia- bility
Dealers, including executive and clerical force	\$0.61	...
Automobile and body manufacturing (exclusively) .....	.74	\$0.05
Automobile manufacturing (turning out automobiles complete) ..	.56	.03
Automobile manufacturing—assembly of manufactured parts only .....	.51	.03
Automobile radiator manufacturing .....	.74	.05
Automobile salesrooms (no garage or repair shop) .....	.33	.10
Automobile top manufacturing ..	.45	.05
Automobile windshield manufacturing .....	.56	.05

Simms Magneto and Generator on Maxwell Record Holder

LOS ANGELES, CAL., Jan. 14—The Maxwell stock car, which established a record of 22,022.3 miles of continuous running for nearly 44 days under A. A. A. sanction in this city, was equipped with a Simms magneto and a Simms Huff generator, which were in perfect condition at the completion of the test. The car was stopped voluntarily by the local agent and was started 50 sec. later, the starter working perfectly. The car has been run 2000 miles since Jan. 5 without any part of the machine being touched.

Haynes Offers Twin Six for Oldest Car

KOKOMO, IND., Jan. 18—The Haynes Automobile Co., this city, is offering a Haynes Twin Six to the owner of the oldest Haynes automobile in America. The company is desirous of procuring its oldest car now in service. This will be an even trade. Owners of the old Haynes cars are requested to send in their names to the factory in this city, together with complete descriptions of the cars.

Herreshoff Creditors to Get 30 Per Cent

DETROIT, MICH., Jan. 12—The Detroit Trust Co., has announced that the creditors of the defunct Herreshoff Motor Co., will receive approximately 30 per cent of their claims. Thus far the trust company has paid 17 per cent in dividends. The claims filed totaled \$213,967.92. This amount has been reduced to \$95,570.49 owing to the discovery of duplications, withdrawals and disallowances. Claims totaling \$616.85 are undecided.

Missouri's 1915 Registration 76,462

JEFFERSON CITY, MO., Jan. 12—The total registration of motor vehicles in Missouri during the year 1915 was 76,462, according to figures made public by State officials here. The total amount turned into the State treasury from automobile registrations was \$323,292.50. Applications for 1916 licenses are coming in at the rate of 2000 a day.

N. Y. Registrations Increased

Prediction of 275,000 Cars in 1916—31,400 Cars Licensed in Metropolitan District

NEW YORK CITY, Jan. 15—Predictions of automobile registration of 275,000 for New York State in 1916 are based on the rush for licenses during the last fourteen days. In the metropolitan district 31,400 automobiles have been licensed so far, as against 22,000 for the same period last year. Chauffeurs licensed number 11,125, against 12,000 in the first two weeks of 1915. Licenses issued to chauffeurs and automobiles so far this year have brought a revenue to the State of \$285,000. Last year's revenue for the corresponding period was \$202,000. For all of last year in the district 110,000 automobiles and 55,000 chauffeurs were licensed.

Pennsylvania Registrations for 10 Years \$6,000,000

HARRISBURG, PA., Jan. 17—During the past ten years that the State of Pennsylvania has been licensing automobiles more than \$6,000,000 in fees has been turned into the automobile division of the State Highway department. In 1906, the first year the State licensed automobiles, the State highway department received \$42,460.42. In 1915, the tenth year for licenses, the revenue from motor vehicles was \$1,665,276.50. The revenue by years has been: 1906, \$42,460.42; 1907, \$59,604.91; 1908, \$83,920.69; 1909, \$126,954.95; 1910, \$321,989.12; 1911, \$492,523.50; 1912, \$597,723.19; 1913, \$841,069.41; 1914, \$1,184,646.50; 1915, \$1,665,276.50.

A Traffic Court for N. Y.?

NEW YORK CITY, Jan. 14—A traffic court has been suggested for this city to settle all traffic cases. Mayor Mitchel, who suggested the plan, thinks that the present traffic difficulties of the city would be greatly lessened by the establishment of a special Magistrate's Court which would have jurisdiction over all traffic cases, or at least over as many as could be brought to one locality, and which would be tried as a class by themselves.

Kansas City Cars Gain 33 Per Cent

KANSAS CITY, MO., Jan. 1—The registration of automobiles in this city increased practically a third during the year 1915. Final registration figures in the city license department show that the last license for the year was No. 9774, issued on Dec. 24. As all licenses must be renewed on Jan. 4, no others

were issued during the remainder of 1915.

The number of licenses granted in Kansas City since 1908 follow:

Year	Licenses
1908 (half year only)	331
1909	1,184
1910	2,194
1911	3,376
1912	4,359
1913	5,430
1914	6,721
1915	9,774

Eight-Story Overland Service Building in New York

NEW YORK CITY, Jan. 14—An eight-story warehouse and automobile service building for the Willys-Overland company at 521 to 531 West Fifty-seventh Street, through to 518, 524 and 528 West Fifty-eighth Street will be built. The plans call for a fireproof structure of reinforced concrete construction which will cost approximately \$300,000.

Adds 1500 Automobile Cars

NEW YORK CITY, Jan. 14—The Lehigh Valley Railroad has placed orders for 1500 new automobile cars, which will be 40 ft. long, with 10-ft. double staggered doors, and will have both steel underframes and steel ends.

No Duty on Cars in Paraguay

ASUNCION, PARAGUAY, Dec. 31—A law enacted Nov. 8, 1915, provides that unused vehicles, including automobiles and trucks, together with their accessories and spare parts, shall be exempt from import duty in Paraguay for a period of two years from that date. The suspended duty on motor vehicles imported into that country amounts to 62 per cent ad valorem, including surtaxes.

Better Trip Reset on 1916 Speedometers

(Concluded from page 138)

Like similar instruments it is a centrifugal type with a hand covering a dial reading up to 60 m.p.h. The trip mileage reads to 100 and the season mileage to 100,000. The latest Ford type, model FF-16, is mounted flush with the dash or the windshield strip, and sells for \$15.

Garford

No changes have been made in the Garford instrument. It is a centrifugal type using a revolving ball race mounted on the main driveshaft. In this race are ½-in. steel balls held in place by an inverted steel cup. The inner surface of the cup is so designed that the centrifugal force of the steel balls which travel in radial cam grooves, raises the cup in proportion to the car speed. The movement of the cup is transmitted to the indicating needle. The Ford type lists at \$12.50 and a larger size at \$15.

Factory Miscellany

Peerless Tube to Add—The Peerless Tube Co., Bloomfield, N. J., will erect an addition to cost \$13,100.

Tower to Build Trucks—R. J. Tower is planning to construct a motor-truck factory at Greenville, Mich.

Winton Building Addition—The Winton Co., Cleveland, Ohio, is erecting an addition to its plant at Berea Road, to be 80 by 300 ft.

Ward-Leonard to Build—The Ward-Leonard Electric Co., Bronxville, N. Y., will build a two-story plant, 100 by 185 ft., which will cost \$35,000.

Jackson Top Co. Formed—The Jackson Winter Top and Special Body Works, Jackson, Mich., was recently formed in Jackson, Mich., to make automobile tops and bodies. Headquarters are at North Columbus Street.

Rochester Motors Factory—The Rochester Motors Co., Rochester, N. Y., is erecting a brick fireproof factory on Wren Street at an estimated cost of \$9,000. The new structure will be 62 by 150 ft. and one story high.

Chester Rubber to Build—The Chester Rubber Tire & Tube Co., Chester, W. Va., will take bids in March for a plant to cost \$720,000, including three structures, one 50 by 170 ft., another 40 by 75 ft. and the third 42 by 75 ft.

Ohio Motor Makes Lease—The Ohio Motor Mfg. Co., Springfield, Ohio, capitalized at \$500,000, has leased part of the plant of the Winters-Coleman Scale Co. and will install machinery to manufacture internal combustion engines. The company is contemplating the erection of a large plant at Canton, Ohio.

Takes Over Automatic Screw—The Gas Motor Efficiency Co., Janesville, Wis., has taken over the business of the Automatic Screw Machine Co., Janesville, which has manufactured spark plugs for several years. The spark plug department will be greatly enlarged, while the production of liquid fuel vaporizers will also be increased.

Rockwell-Drake Plant in Plainville—The Rockwell-Drake Co. will begin the building of a one-story factory 100 by

130 ft. on a site in Plainville, Conn., recently purchased by Albert F. Rockwell, late of the New Departure Mfg. Co. The company, among other things, manufactures ball bearings and is now located at 78 Grove Street, Hartford.

Newcastle Co. to Sell Homes to Employees—The Greater Newcastle Co., with a capital stock of \$100,000, has been formed in Newcastle, Ind., Jan. 10, those interested being President Walter E. Flanders and others connected with the Maxwell Motor Co. The purpose of the new company is to build, rent and sell homes to workingmen of the Maxwell plants.

35,000 on Ford Payroll—Including the main plant of the Ford Motor Co., Detroit, Mich., the total number of office and shop workers and officials now on the payroll of the company is close to 35,000. Of this number there are more than 24,000 men employed in the plant here. The office force, shop foremen, superintendents and inspectors aggregate another 1,000 men employed here in Detroit.

The Automobile Calendar

Jan. 15-22.....	Detroit, Mich., Show, Detroit Automobile Dealers' Assn.	Feb. 1-5.....	York, Pa., Show, York Auto Dealers' Assn.	Feb. 21-26.....	Syracuse, N. Y., Show, Syracuse Automobile Dealers.
Jan. 17-19.....	Erie, Pa., Show, Erie Automobile Dealers' Assn.	Feb. 2-5.....	Buffalo, N. Y., Show, Auditorium, Buffalo Automobile Mfrs. and Dealers' Assn.	Feb. 23-Mar. 3....	Pittsburgh, Pa., Convention of American Road Builders' Assn., Mechanical Hall.
Jan. 17-22.....	Rochester, N. Y., Show, Exposition Park, C. A. Simmons, Mgr.	Feb. 2-5.....	Poughkeepsie, N. Y., Show, State Armory.	Feb. 23-March 4..	Paterson, N. J., Fifth Annual Show, Auditorium.
Jan. 17-22.....	Wilmington, Del., Show, Wilmington Automobile Show Assn.	Feb. 7-12.....	Kansas City, Mo., Show, J. I. Case, T. M. Bldg., Kansas City Motor Dealers' Assn.	Feb. 29-Mar. 4....	Ft. Dodge, Ia., Show, Terminal Bldg., Ft. Dodge Automobile Dealers' Assn.
Jan. 18-21.....	Fargo, N. D., Show, North Dakota and Minnesota Automobile Dealers' Assn.	Feb. 7-12.....	Duluth, Minn., Show, Armory, Duluth Automobile Dealers' Assn.	March 4-11.....	Boston, Mass., Car and Truck Show, Mechanics Bldg.
Jan. 18-22.....	Baltimore, Md., Show, Fifth Regiment Armory.	Feb. 8-11.....	Grand Forks, N. D., Show, Auditorium.	March 8-11.....	Davenport, Ia., Show, Tri-City Davenport, Rock Island & Moline; Tri-City Automobile Trade Assn.
Jan. 25-29.....	Lancaster, Pa., Show, Conestoga Park Pavilion.	Feb. 9-12.....	Peoria, Ill., Show, Coliseum, Peoria Automobile and Accessory Assn.	Mar. 8-11.....	Mason City, Ia., Show, Armory.
Jan. 22-29.....	Montreal, Que., Show, Almy's Bldg., Automobile Trade Assn., Ltd.	Feb. 12-19.....	Albany, N. Y., Show.	March 8-15.....	Brooklyn, N. Y., Show, Brooklyn Motor Dealers' Assn.
Jan. 22-29.....	Chicago, Ill., Show, National Automobile Chamber of Commerce; Coliseum and First Regiment Armory.	Feb. 12-19.....	Hartford, Conn., Show, First Regiment Armory, Hartford Automobile Dealers' Assn.	Mar. 21-25.....	Deadwood, S. D., Show, Auditorium, Deadwood Business Club.
Jan. 24-29.....	Buffalo, N. Y., Show, Buffalo Automobile Dealers' Assn., Broadway Auditorium.	Feb. 14-19.....	Nashville, Tenn., Show, Hippodrome, J. A. Murkin, Mgr.	Mar. 28-Apr. 3....	Manchester, N. H., Show, Under Auspices Couture Bros. Academy.
Jan. 24-29.....	Scranton, Pa., Passenger Car Show, Town Hall.	Feb. 14-19.....	Des Moines, Ia., Show, Des Moines Auto. Dealers' Assn.	May 13.....	New York City, Vanderbilt Cup, Sheephead Bay Speedway Race.
Jan. 24-30.....	Portland, Ore., Show, Armory, Portland Automobile Dealers' Trade Assn.	Feb. 14-19.....	Winnipeg, Man., Show, Ford Plant, Winnipeg Motor Trades Assn.	May 20.....	Chicago, Ill., Amateur Drivers' Race, Chicago Motor Speedway.
Jan. 25, 26, 27....	Montgomery, Ala., Show, Klein Bldg., Montgomery Automobile and Accessories Dealers.	Feb. 19.....	Newark, N. J., Show, First Regiment Armory, C. G. Fitzgerald, Mgr.	May 30.....	Indianapolis Track Race.
Jan. 29-Feb. 5....	Columbus, Ohio, Show, Memorial Hall, Columbus Automobile Show Co.	Feb. 20-27.....	Grand Rapids, Mich., Show, Klingman Furniture Exhibition Bldg., Automobile Business Assn.	June 17.....	Chicago Track Race.
Jan. 29-Feb. 5....	Minneapolis, Minn., Show, National Guard Armory, Minneapolis Trade Assn.	Feb. 21-26.....	Bridgeport, Conn., Show, State Armory, B. B. Steibler, Mgr.	June 28.....	Des Moines, Ia., Track Race.
Jan. 31.....	Scranton, Pa., Show, Commercial Car Show, Town Hall, H. B. Andrews, Mgr.	Feb. 21-26.....	Louisville, Ky., Show, First Regiment Armory.	July 4.....	Minneapolis Track Race.
Jan. 31-Feb. 5....	Fall River, Mass., Show, State Armory, R. C. Borden, Mgr.	Feb. 21-26.....	Omaha, Neb., Show, Omaha Automobile Show Assn.	July 4.....	Sioux City Track Race.
Feb. 1-3.....	Frederick, Md., Show, Armory.	Feb. 21-26.....	Portland, Me., Show, Exposition Bldg.	July 15.....	Omaha, Neb., Track Race.
		Feb. 21-26.....	South Bethlehem, Pa., Show, Coliseum, J. S. Elliot, Mgr.	Aug. 5.....	Tacoma Track Race.

The Week in the Industry



Bissett Sales Mgr.—H. E. Bissett has become sales manager of the Michigan Specialties Co., Detroit.

Valentine Standard Tire Sales Manager—R. F. Valentine has become sales manager of the Standard Tire & Rubber Co., Cleveland, Ohio.

Kearney Heads Fisk Dept.—J. M. Kearney has been promoted to head of the service department of the New York branch of the Fisk Rubber Co.

Herold Joins Dodge Distributor—F. J. Herold has become general sales and service manager of Henry Bros., distributors of Dodge cars in Union, N. J.

Robinson Portland Kissel Mgr.—A. S. Robinson of San Francisco and one-time manager of the Los Angeles branch for the KisselKar, has been appointed manager of the Portland, Ore., KisselKar branch.

Stockbridge Succeeds Johnson—F. W. Stockbridge, sales supervisor in the East for the Winton Co., is new manager for the factory branch in Minneapolis, Minn. He succeeds J. S. Johnson, resigned after eleven years' connection.

Nerney Kissell Mgr.—H. W. Nerney, formerly one of the State representatives of the Pacific KisselKar branch, has been appointed manager of the San Diego house of the Pacific KisselKar, which was opened recently.

Jackson Joins Westinghouse—A. E. Jackson has been made Western representative of the automobile equipment department of the Westinghouse Electric & Mfg. Co., East Pittsburgh. His headquarters will be at 2007 South Michigan Avenue, Chicago.

Dealer

Minneapolis Chevrolet Makes Change—The Minnesota Motor Car Co., Minneapolis, which handles Chevrolet cars in the Northwest, has decided to combine its place of business with the assembling plant which the Chevrolet Motor Co. will build on a site to be announced about Feb. 1. The building is to be completed by July 15.

Gets Sunderman Carbureter for New York City—The J. F. Renfro Co., Inc., New York City, has been appointed exclusive factory distributor for the Sunderman safety carbureter, and the former local sales office has been discontinued. All shipments are being made from Newburgh, N. Y., where 500 carbureters are being made a day.

Motor Men in New Roles

Conlon Federal Truck Sales Mgr.—H. A. Conlon has been appointed district sales manager by the Federal Motor Truck Co., his territory consisting of the Middle West. He was formerly with the company's Boston and Providence headquarters.

Hare Resigns—E. S. Hare, for 10 years with the Philadelphia branch of the Commercial Truck Co. of America, has resigned and will be special representative of the Packard company in that city and New York. Mr. Hare is president of the Philadelphia Motor Truck Assn.

Magruder Makes Change—George Magruder, well known on the Pacific coast and formerly identified with the Northwest Auto Co. of Los Angeles, is now in charge of the repair department for Manley-Thompson Brothers in Tacoma, Wash., Chevrolet distributors.

Scharps Joins Silver—C. E. T. Scharps will assume on Feb. 1 the management of the wholesale department of the C. T. Silver Co., New York representative of the Overland and Peerless cars. He was formerly automobile editor and advertising manager of the Sun, New York City.

Sigwalt Resigns—H. T. Sigwalt, who has been with the Federal Motor Truck Co., Detroit, Mich., during the past 18 months as advertising manager, has resigned. He has been succeeded by G. W. Cushing of the Detroit Board of Commerce, where he was editor of the *Detroit*, the board's weekly.

Van Horn Oakland Sales Mgr.—W. H. Van Horn, formerly of Findlay, Ohio, has been named sales manager of the Hannon Motor Sales Co. of Tulsa, Okla., handling the Oakland line in several counties of the State. Mr. Van Horn was the Oakland representative in Findlay.

Underberg Advanced to Branch Mgr.—C. H. Underberg, in charge of the Tacoma office of the Fisk Rubber Co. has been advanced to the post of branch manager in Tacoma. W. E. Bayless has been advanced to the position of northern coast district manager, with offices in Seattle. He will have charge of the territory in Washington, Oregon, Idaho and British Columbia.

Thomsen Sells Mitchell in Davenport—Henry Thomsen, Davenport, Iowa, has purchased the McGovern Motor Co., 115 Harrison Street, that city, and the concern will be hereafter known as the

Thomsen Motor Co. J. A. Zeaman will be retained as general manager. The Mitchell car will be handled and supplies sold.

Deibler Mgr. for Newman—Harry Newman, Inc., 702 Grand Avenue, Milwaukee, Wis., Chalmers distributor for Wisconsin, upper Michigan and southern Minnesota, has appointed J. B. Deibler, Chicago, general manager. Mr. Deibler is a native of Berlin, Wis., and has been associated with the automobile business for fifteen years. He served the Haynes as Chicago branch manager for eight years and later took the Pope-Hartford representation. In 1901 he made the first long-distance run in a self-propelled vehicle in this part of the country, driving an old Milwaukee steamer from Milwaukee to Oshkosh and return. It was the first product of the former Milwaukee Automobile Co., one of the first motor car manufacturers in the United States.

Dealer

Washington Items—Stewart-Warner Speedometer Corp., Seattle, Wash., has opened a new service station at 1710 Broadway under the management of T. M. Hart. The Seattle station will be run under the name of the Stewart products service station.

Through the initiative of the Portland Garage Owners' Association a meeting has been called to organize a State association of garage men.

Agencies for Hudson cars in the State of Washington have been appointed as follows: Washington Auto Co., North Yakima; F. M. Powell, Everett; W. H. Bland, Bellingham; C. T. Scurry, Aberdeen; Walker's Garage, Hoquiam; Rasmussen's Garage, Kent; Howe's Garage, Port Angeles; E. C. Tew, Olympia; W. J. Bendennick, Bremerton; Raymond Auto Co., Raymond.

Two New Buildings for Minneapolis—Two new automobile buildings are to be erected, one by the Willys-Overland Co. and the other by the Northwestern Automobile Co. The latter is to be at Harmon Place and Willow Street, opposite the new building for the Hudson and Locomobile cars. It will house Saxon and Chandler cars. The former is to stand on a tract made up of a new purchase of land adjoining a tract bought from Bowman & Libby, Inc., when it took over the Northwestern distributing agency. It is one block from the Automobile Show headquarters.